LH4-B800E

SERVICE MANUAL

Electronic
Excellent
Economical
E Series

Please read this manual before making any adjustments.

ELECTRONIC LOCKSTITCH BUTTON HOLER

brother

Thank you very much for buying a BROTHER sewing machine. Before using your new machine, please read the safety instructions below and the explanations given in the instruction manual.

With industrial sewing machines, it is normal to carry out work while positioned directly in front of moving parts such as the needle and thread take-up lever, and consequently there is always a danger of injury that can be caused by these parts. Follow the instructions from training personnel and instructors regarding safe and correct operation before operating the machine so that you will know how to use it correctly.

SAFETY INSTRUCTIONS

1. Safety indications and their meanings

This instruction manual and the indications and symbols that are used on the machine itself are provided in order to ensure safe operation of this machine and to prevent accidents and injury to yourself or other people.
The meanings of these indications and symbols are given below.

Indications

DANGER	The instructions which follow this term indicate situations where failure to follow the instructions will almost certainly result in death or severe injury.
CAUTION	The instructions which follow this term indicate situations where failure to follow the instructions could cause injury when using the machine or physical damage to equipment and surroundings

Symbols

..... This symbol (△) indicates something that you should be careful of. The picture inside the triangle indicates the nature of the caution that must be taken.
(For example, the symbol at left means “beware of injury”.)

..... This symbol (⃠) indicates something that you must not do.

..... This symbol (●) indicates something that you must do. The picture inside the circle indicates the nature of the thing that must be done.
(For example, the symbol at left means “you must make the ground connection”.)

⚠ DANGER

Wait at least 5 minutes after turning off the power switch and disconnecting the power cord from the wall outlet before opening the face plate of the control box. Touching areas where high voltages are present can result in severe injury.

⚠ CAUTION

Environmental requirements

- Use the sewing machine in an area which is free from sources of strong electrical noise such as high-frequency welders.
  Sources of strong electrical noise may cause problems with correct operation.
- Any fluctuations in the power supply voltage should be within ±10% of the rated voltage for the machine.
  Voltage fluctuations which are greater than this may cause problems with correct operation.
- The power supply capacity should be greater than the requirements for the sewing machine's electrical consumption.
  Insufficient power supply capacity may cause problems with correct operation.
- The ambient temperature should be within the range of 5°C to 35°C during use.
  Temperatures which are lower or higher than this may cause problems with correct operation.
- The relative humidity should be within the range of 45% to 85% during use, and no dew formation should occur in any devices.
  Excessively dry or humid environments and dew formation may cause problems with correct operation.
- Avoid exposure to direct sunlight during use.
  Exposure to direct sunlight may cause problems with correct operation.
- In the event of an electrical storm, turn off the power and disconnect the power cord from the wall outlet.
  Lightning may cause problems with correct operation.

Installation

- Machine installation should only be carried out by a qualified technician.
- Contact your Brother dealer or a qualified electrician for any electrical work that may need to be done.
- The sewing machine weighs more than 56 kg. The installation should be carried out by two or more people.
- Do not connect the power cord until installation is complete, otherwise the machine may operate if the treadle is pressed by mistake, which could result in injury.
- Use both hands to hold the machine head when tilting it back or returning it to its original position. If only one hand is used, the weight of the machine head may cause your hand to slip, and your hand may get caught.
- Be sure to connect the ground. If the ground connection is not secure, you run a high risk of receiving a serious electric shock, and problems with correct operation may also occur.
- All cords should be secured at least 25 mm away from any moving parts. Furthermore, do not excessively bend the cords or secure them too firmly with staples, otherwise there is the danger that fire or electric shocks could occur.
- Install the belt covers to the machine head and motor.
- If using a work table which has casters, the casters should be secured in such a way so that they cannot move.
- Be sure to wear protective goggles and gloves when handling the lubricating oil and grease, so that they do not get into your eyes or onto your skin, otherwise inflammation can result.
  Furthermore, do not drink the oil or eat the grease under any circumstances, as they can cause vomiting and diarrhoea.
  Keep the oil out of the reach of children.

⚠ CAUTION

Sewing

This sewing machine should only be used by operators who have received the necessary training in safe use beforehand.

The sewing machine should not be used for any applications other than sewing.

Be sure to wear protective goggles when using the machine.
If goggles are not worn, there is the danger that if a needle breaks, parts of the broken needle may enter your eyes and injury may result.

Turn off the power switch at the following times, otherwise the machine may operate if the treadle is pressed by mistake, which could result in injury.
- When threading the needle
- When replacing the needle and bobbin
- When not using the machine and when leaving the machine unattended

If using a work table which has casters, the casters should be secured in such a way so that they cannot move.

Attach all safety devices before using the sewing machine. If the machine is used without these devices attached, injury may result.

Do not touch any of the moving parts or press any objects against the machine while sewing, as this may result in personal injury or damage to the machine.

If an error occurs in machine, or if abnormal noises or smells are noticed, immediately turn off the power switch. Then contact your nearest Brother dealer or a qualified technician.

If the machine develops a problem, contact your nearest Brother dealer or a qualified technician.

Cleaning

Turn off the power switch before carrying out cleaning, otherwise the machine may operate if the treadle is pressed by mistake, which could result in injury.

Be sure to wear protective goggles and gloves when handling the lubricating oil and grease, so that they do not get into your eyes or onto your skin, otherwise inflammation can result.
Furthermore, do not drink the oil or eat the grease under any circumstances, as they can cause vomiting and diarrhoea.
Keep the oil out of the reach of children.

Maintenance and inspection

Maintenance and inspection of the sewing machine should only be carried out by a qualified technician.

Ask your Brother dealer or a qualified electrician to carry out any maintenance and inspection of the electrical system.

Turn off the power switch and disconnect the power cord from the wall outlet at the following times, otherwise the machine may operate if the treadle is pressed by mistake, which could result in injury.
- When carrying out inspection, adjustment and maintenance
- When replacing consumable parts such as the rotary hook

Turn off the power switch before inserting or removing the plug, otherwise damage to the control box could result.

If the power switch needs to be left on when carrying out some adjustment, be extremely careful to observe all safety precautions.

Use both hands to hold the machine head when tilting it back or returning it to its original position. If only one hand is used, the weight of the machine head may cause your hand to slip, and your hand may get caught.

Use only the proper replacement parts as specified by Brother.

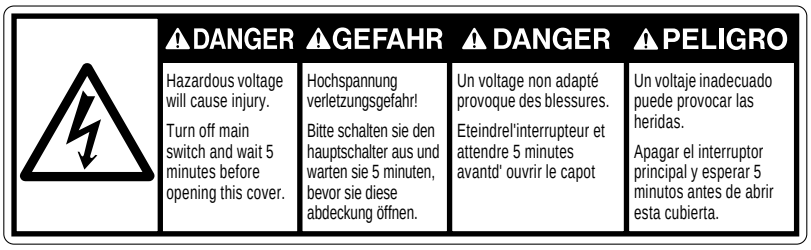
If any safety devices have been removed, be absolutely sure to re-install them to their original positions and check that they operate correctly before using the machine.

Any problems in machine operation which result from unauthorized modifications to the machine will not be covered by the warranty.

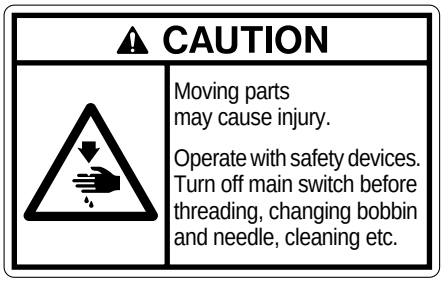
3. Warning labels

The following warning labels appear on the sewing machine.
Please follow the instructions on the labels at all times when using the machine. If the labels have been removed or are difficult to read, please contact your nearest Brother dealer.

1


⚠DANGER
Hazardous voltage will cause injury.
Turn off main switch and wait 5 minutes before opening this cover.
⚠GEFAHR
Hochspannung verletzungsgefahr!
Bitte schalten sie den hauptschalter aus und warten sie 5 minuten, bevor sie diese abdeckung öffnen.
⚠DANGER
Un voltage non adapté provoque des blessures.
Eteindrel'interrupteur et attendre 5 minutes avantd' ouvrir le capot
⚠PELIGRO
Un voltaje inadecuado puede provocar las heridas.
Apagar el interruptor principal y esperar 5 minutos antes de abrir esta cubierta.

2

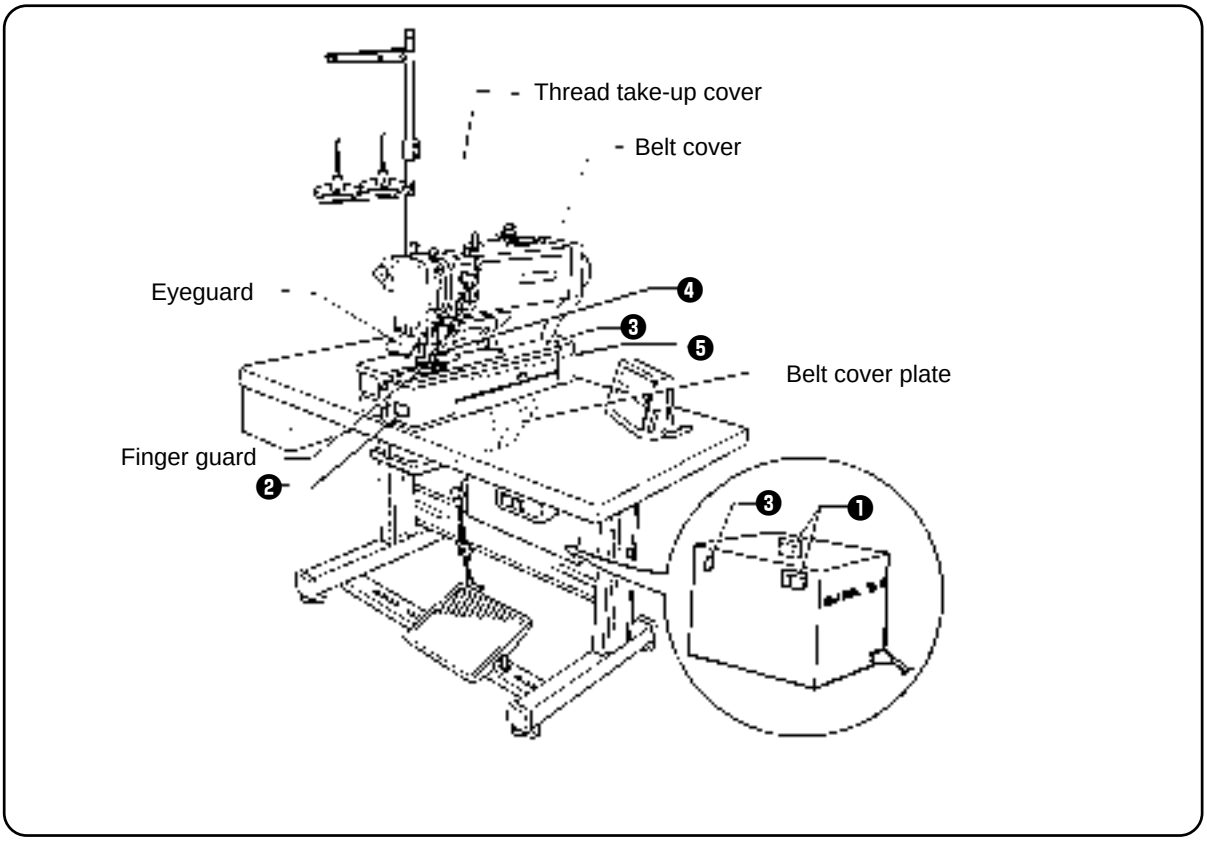

⚠ CAUTION
Moving parts may cause injury.
Operate with safety devices. Turn off main switch before threading, changing bobbin and needle, cleaning etc.

Safety devices
- Eye guard
- Finger guard
- Thread take-up cover
- Belt cover
- Belt cover plate, etc.

3 Be sure to connect the ground. If the ground connection is not secure, you run a high risk of receiving a serious electric shock, and problems with correct operation may also occur.

4 Do not touch any of the cutter or press any objects against the machine while sewing, as this may result in personal injury or damage to the machine.

5 Do not touch any of the fan or press any objects against the machine, as this may result in personal injury or damage to the machine.



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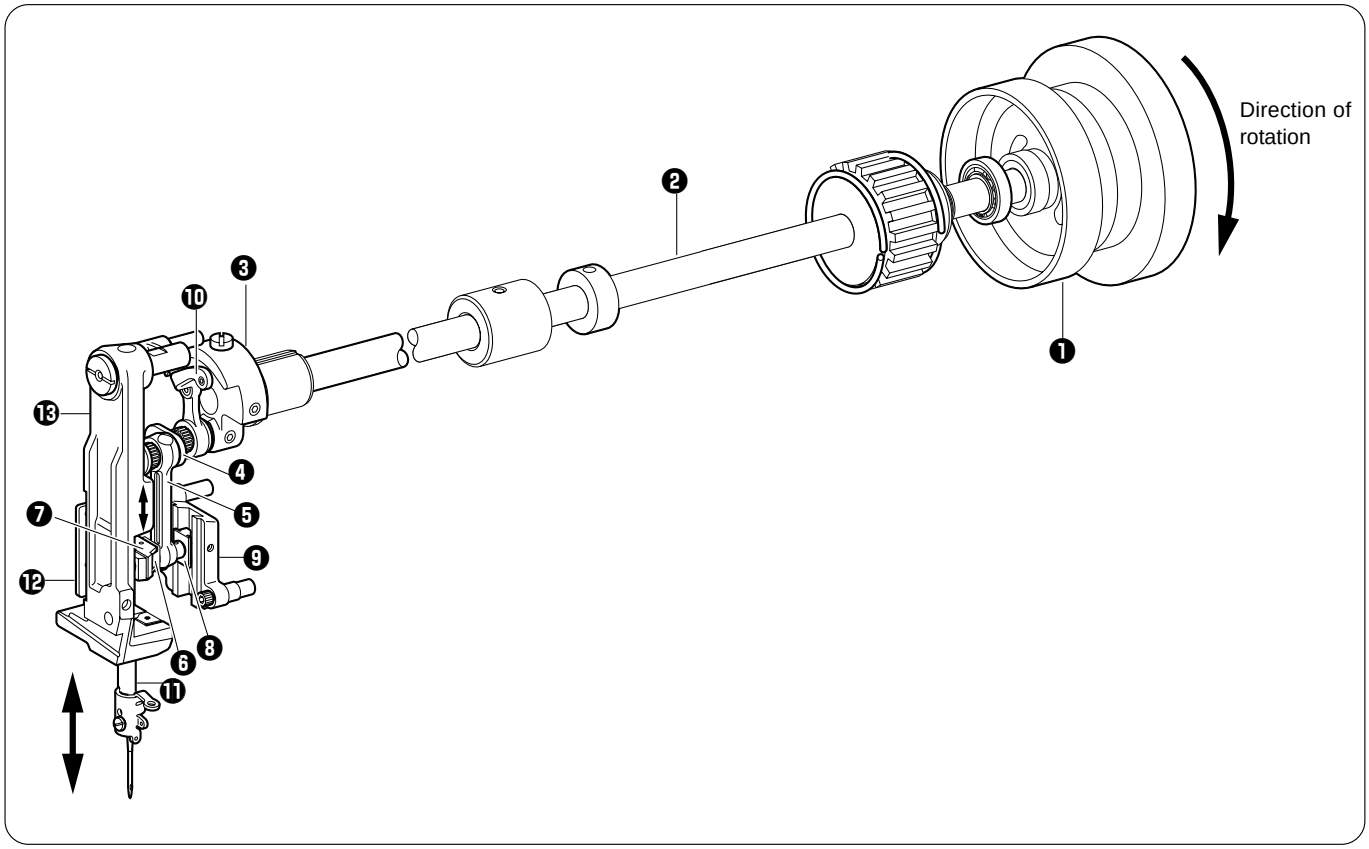
1. MECHANISM DESCRIPTION

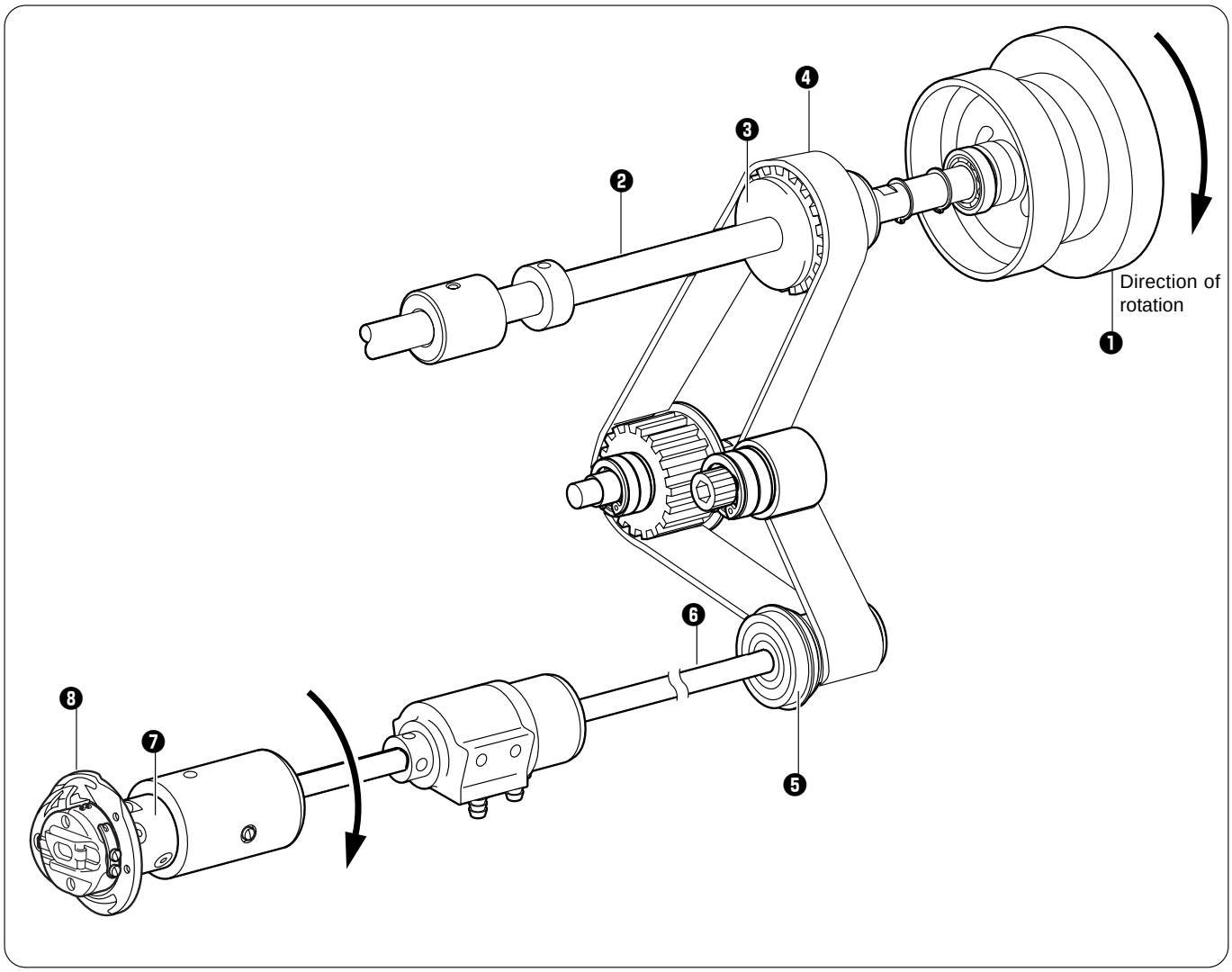
1-1. Needle take-up mechanism



1. When the machine pulley ❶ is turned in the direction of the arrow, the rotation is transmitted to the thread take-up crank ❸ that is secured to the end of the upper shaft ❷.
2. The needle bar crank ❹ is secured to the thread take-up crank ❸, and it transmits vertical motion to the needle bar clamp ❼ via the needle bar crank rod ❺ and needle bar bracket slide rod ❻.

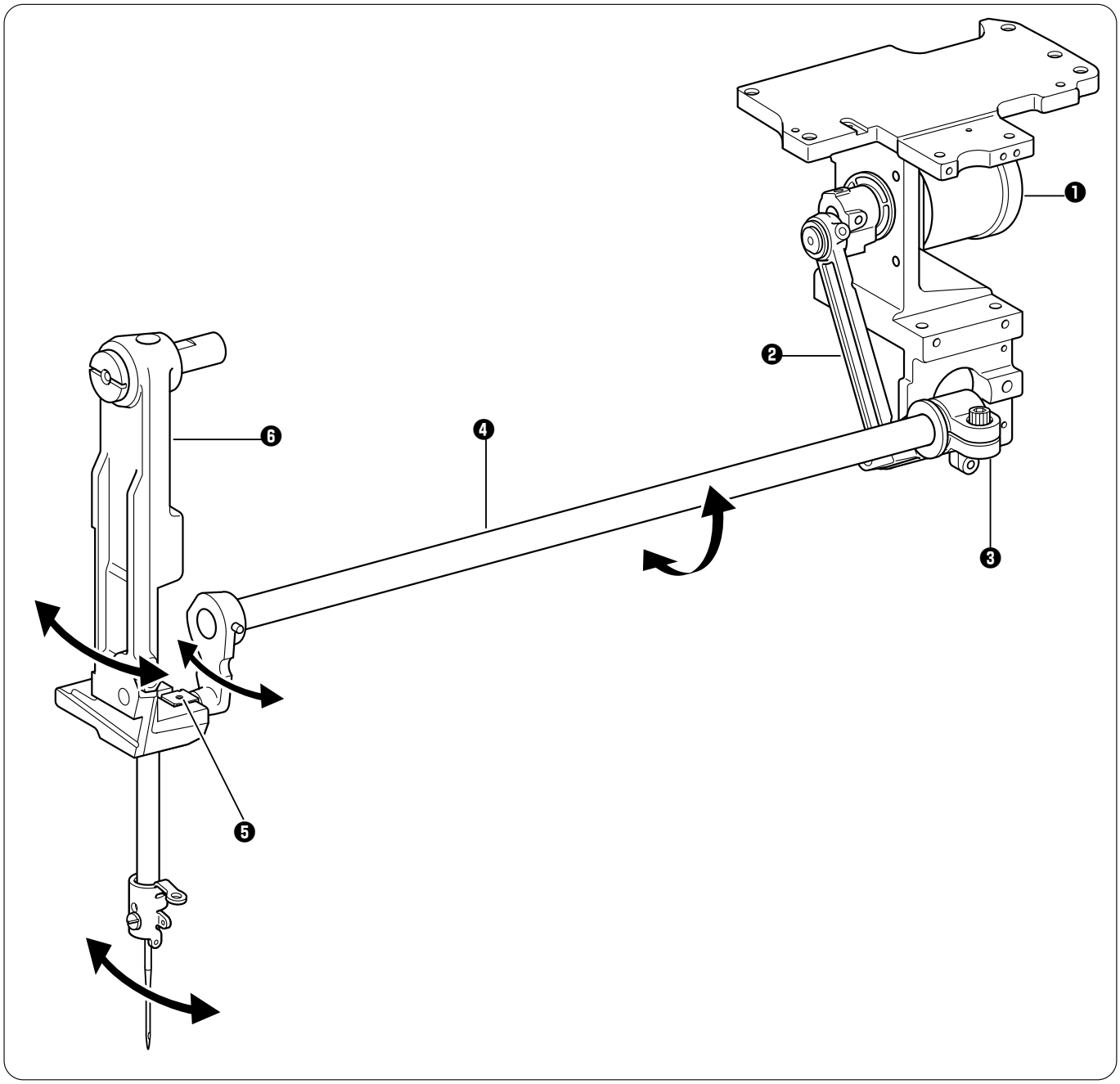
   At this time, the needle bar crank rod ❺ moves together with the crank rod guide ❾ via the needle bar bracket slide rod ❽. (It moves along the slot in the needle hole of the thread take-up ❿ by means of the needle bar crank ❹.)
3. The needle bar ⓫ is secured to the needle bar clamp ❼, and it moves smoothly up and down while being guided by the bushings at the top and bottom of the needle bar guide ⓬ and needle bar bracket ⓭.

1-2. Upper shaft, lower shaft and rotary hook mechanism



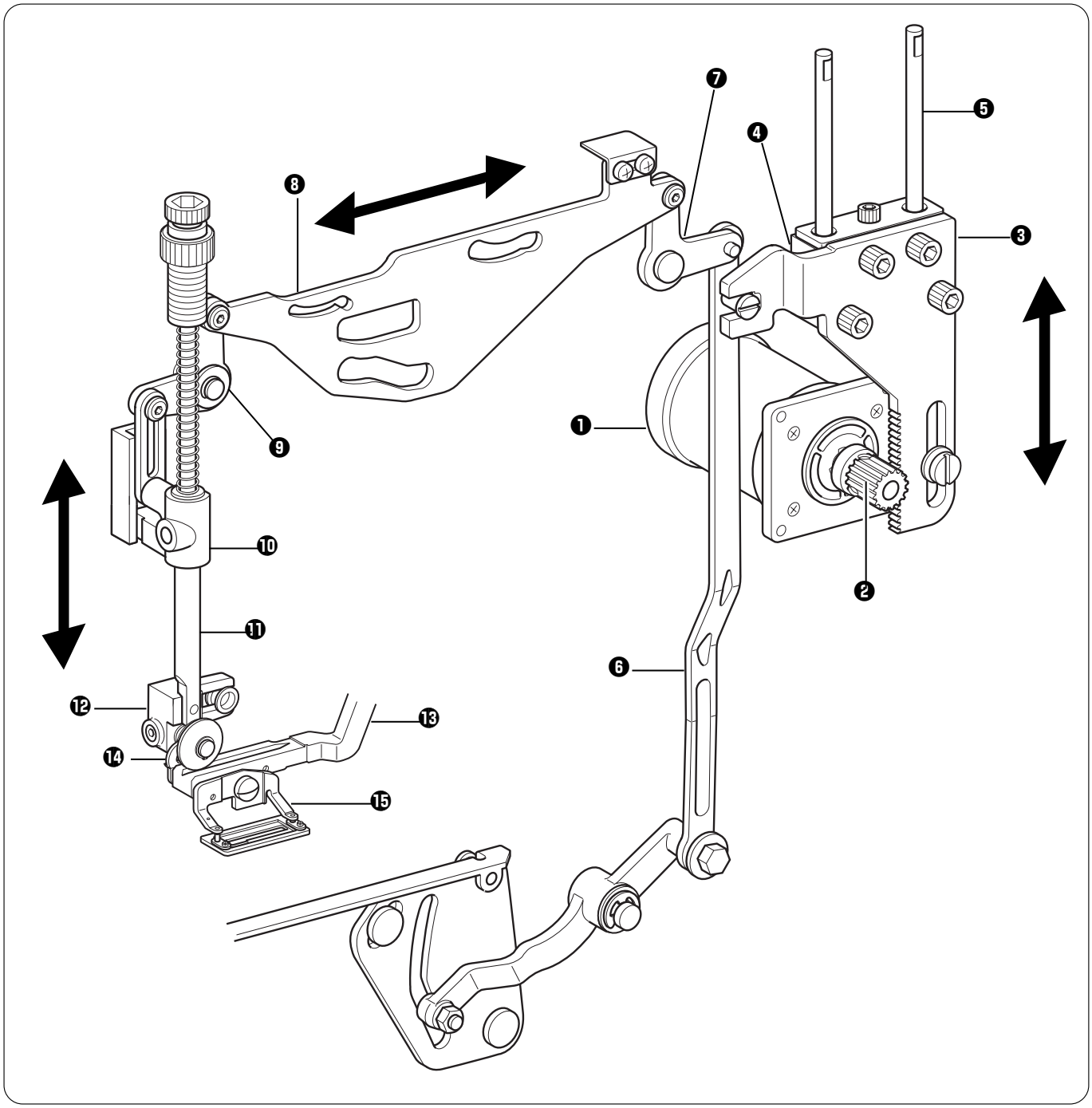
1. When the machine pulley ❶ is turned in the direction of the arrow, the rotation is transmitted to timing pulley U ❸ that is secured to the upper shaft ❷.
2. The timing belt ❹ is attached to timing pulley U ❸, and it accurately transmits the rotation of the upper shaft to the timing pulley ❺.
3. The timing pulley ❺ is secured to the lower shaft ❻, and it transmits the rotation to the rotary hook joint ❼ that is secured to the end of the lower shaft ❻.
4. The rotary hook ❽ is secured to the rotary hook joint ❼ and rotates fully together with the rotary hook joint ❼.

1-3. Needle zigzag mechanism



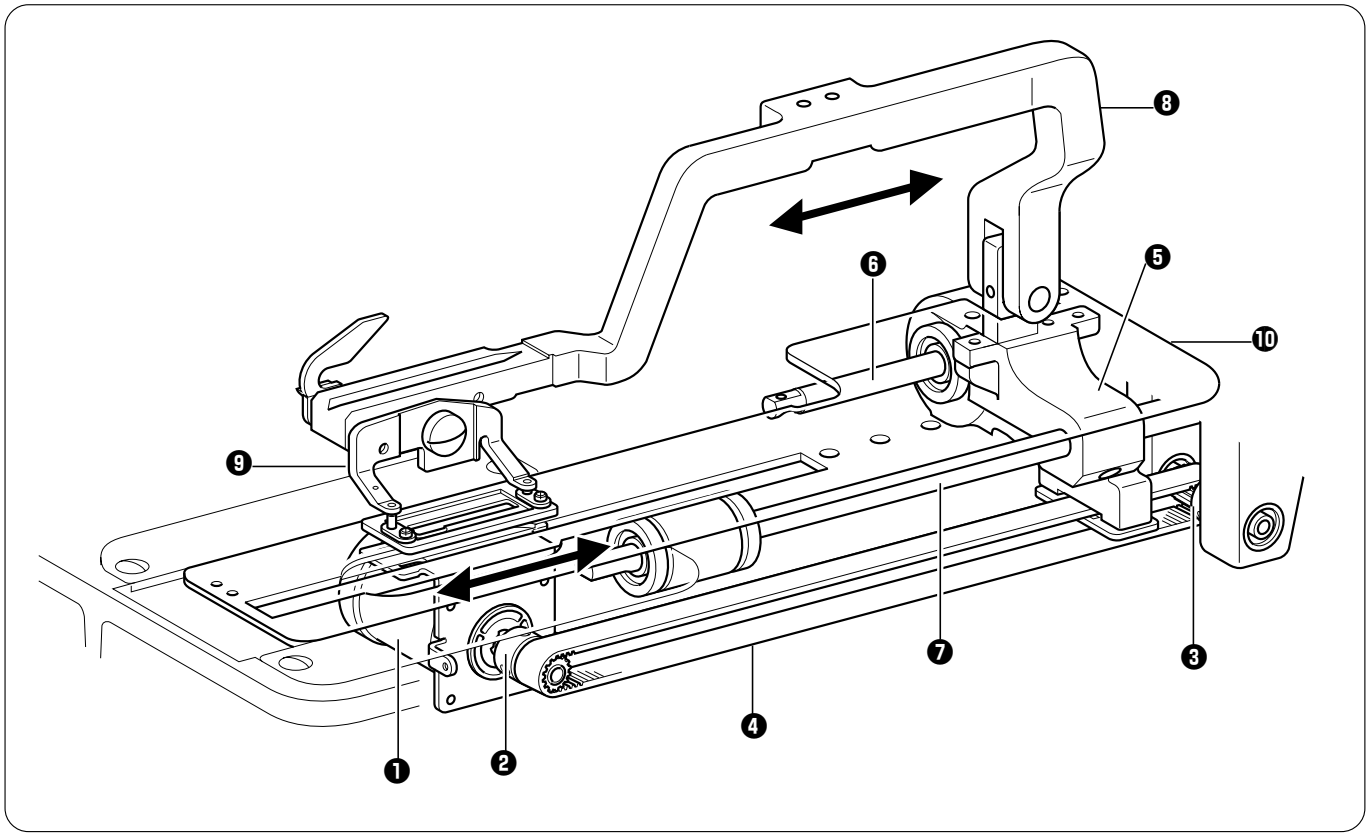
1. The operation of the pulse motor ❶ is transmitted as reciprocal motion to the zigzag lever ❸ via the zigzag connecting rod ❷.
2. The zigzag lever ❸ is secured to the zigzag lever F assembly ❹, and causes the needle bar bracket slide block ❺ that is linked onto the end of the zigzag lever F assembly ❹ to move in a reciprocal motion.
3. The needle bar bracket slide block ❺ is linked to the groove in the needle bar bracket ❻ and causes the needle bar bracket ❻ to move in a reciprocal motion.

1-4. Presser foot lifter mechanism



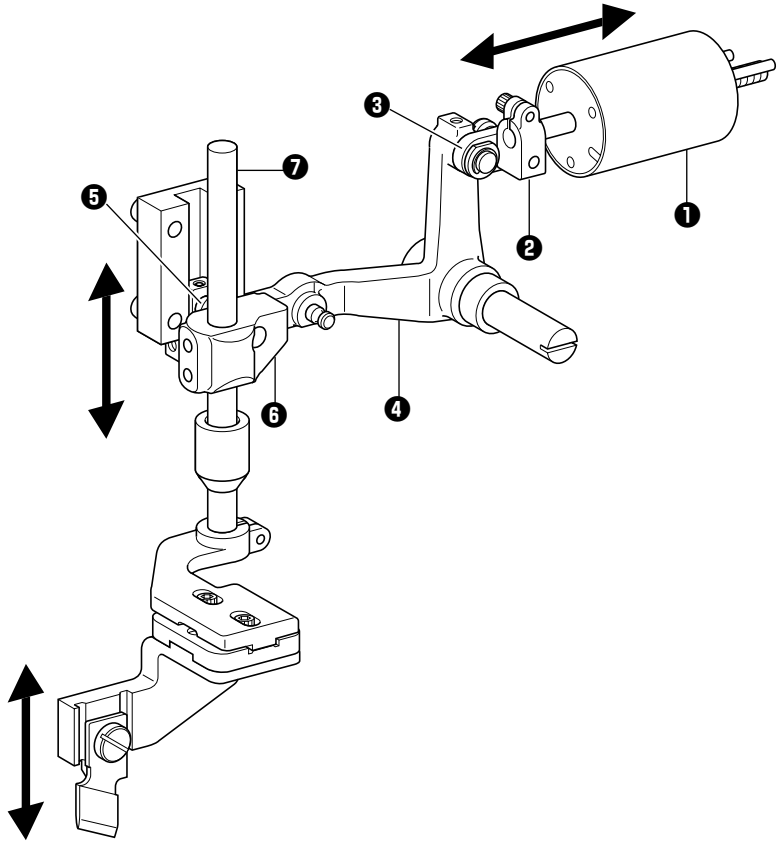
1. When the pulse motor ❶ operates, the gear ❷ that is installed to the pulse motor shaft engages with the presser driving arm ❸ so that the guide bracket ❹ moves along the guide shaft ❺ and moves the presser driving arm ❸ up and down.
2. The presser driving arm ❸ causes the presser foot lifter connecting rod ❻ to move up and down.
3. The movement of the presser foot lifter connecting rod ❻ is transmitted via the knee lifter lever ❼, upper thread trimmer driving link ❽ and knee lifter lever ❾ to move the presser bar guide bracket assembly ❿ up and down.
4. The feed arm ⓫ is secured to the presser bar guide bracket assembly ❿, and it moves the presser roller bracket ⓬ that is secured to the bottom edge of the feed arm ⓫ up and down.
5. Feed arm support ⓮ that is connected to the feed arm ⓭ is hooked onto the presser roller bracket ⓬, and it moves the work clamp ⓯ up and down.

1-5. Feed mechanism



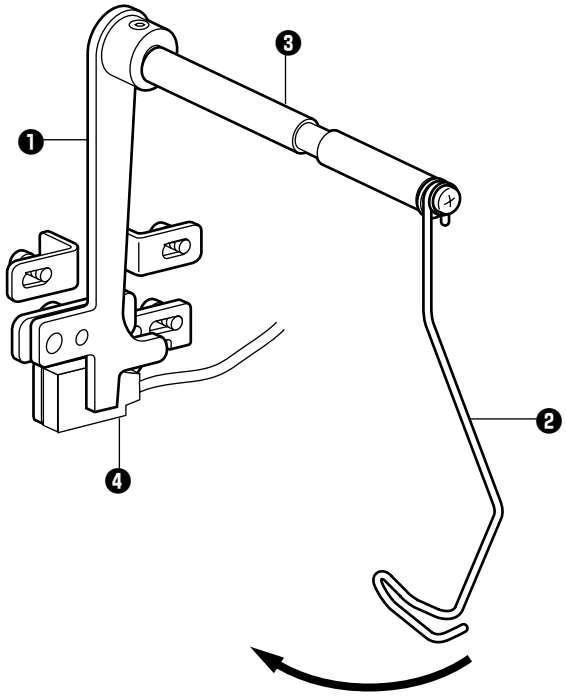
1. A timing belt ❹ is attached to pulley A ❷ that is secured to the pulse motor ❶ and to pulley B ❸, and this timing belt ❹ transmits the motion from the pulse motor ❶.
2. The feed arm support ❺ is secured to the timing belt ❹. The feed arm support ❺ moves back and forth while being guided by feed guide shaft A ❻ and feed guide shaft B ❼.
3. The feed arm ❽ is connected to the feed arm support ❺, and it moves the work clamp ❾ that is installed to the feed arm ❽ and the length feed plate ❿ that is installed to the feed arm support ❺ back and forth.

1-6. Cutter mechanism



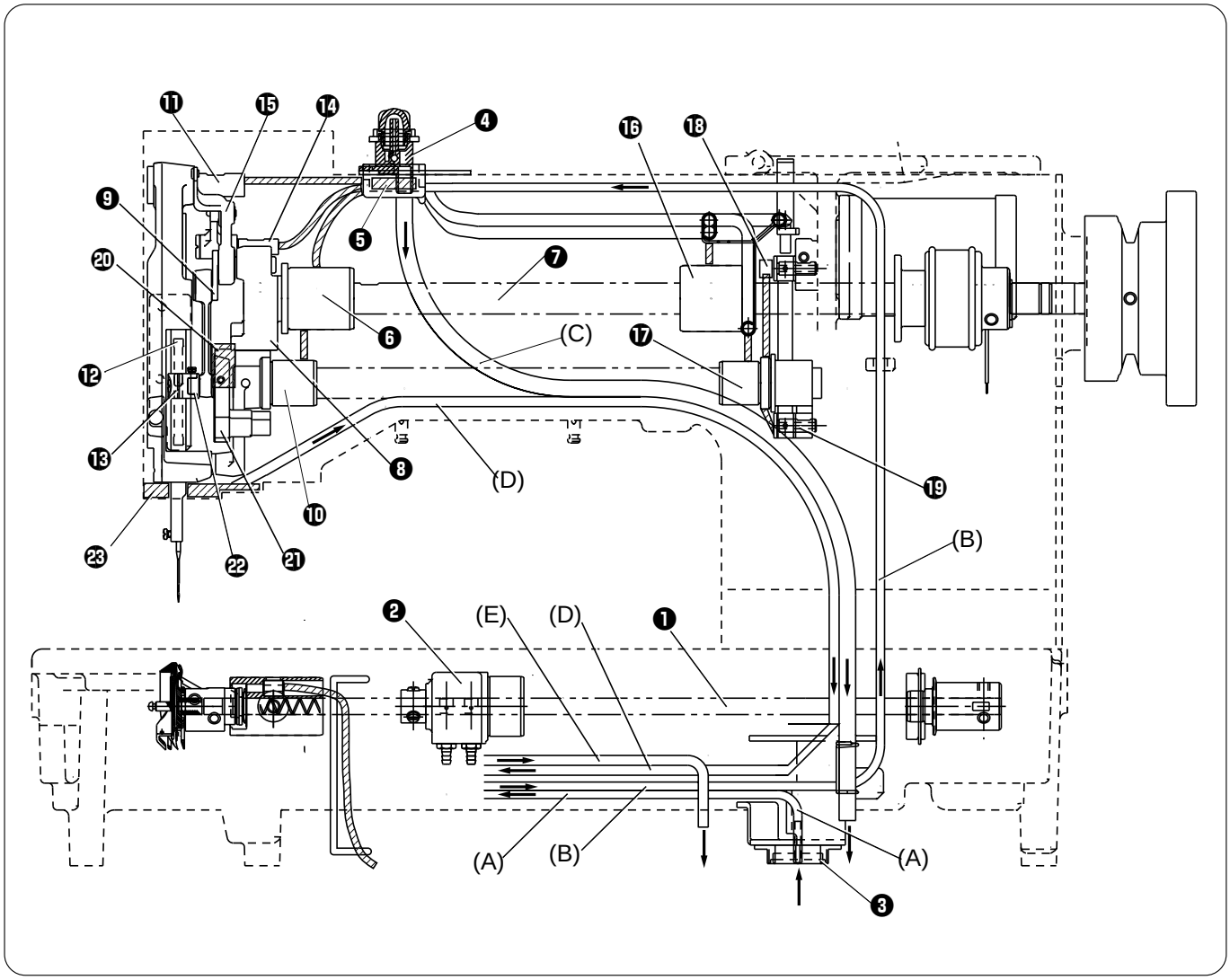
1. When a cutter ON signal is input, the cutter solenoid ❶ operates.
2. A cutter link bracket ❷ is secured to the end of the plunger, and it turns the cutter driving arm ❹ via the cutter driving link ❸.
3. The cutter driving link ❺ that is secured to the end of the cutter driving arm ❹ is moved up and down.
4. The driving shaft holder assembly ❻ is linked to the cutter driving link ❺, and this causes the cutter driving shaft ❼ that is connected to the driving shaft holder assembly ❻ to move up and down.

1-7. Thread breakage detection mechanism



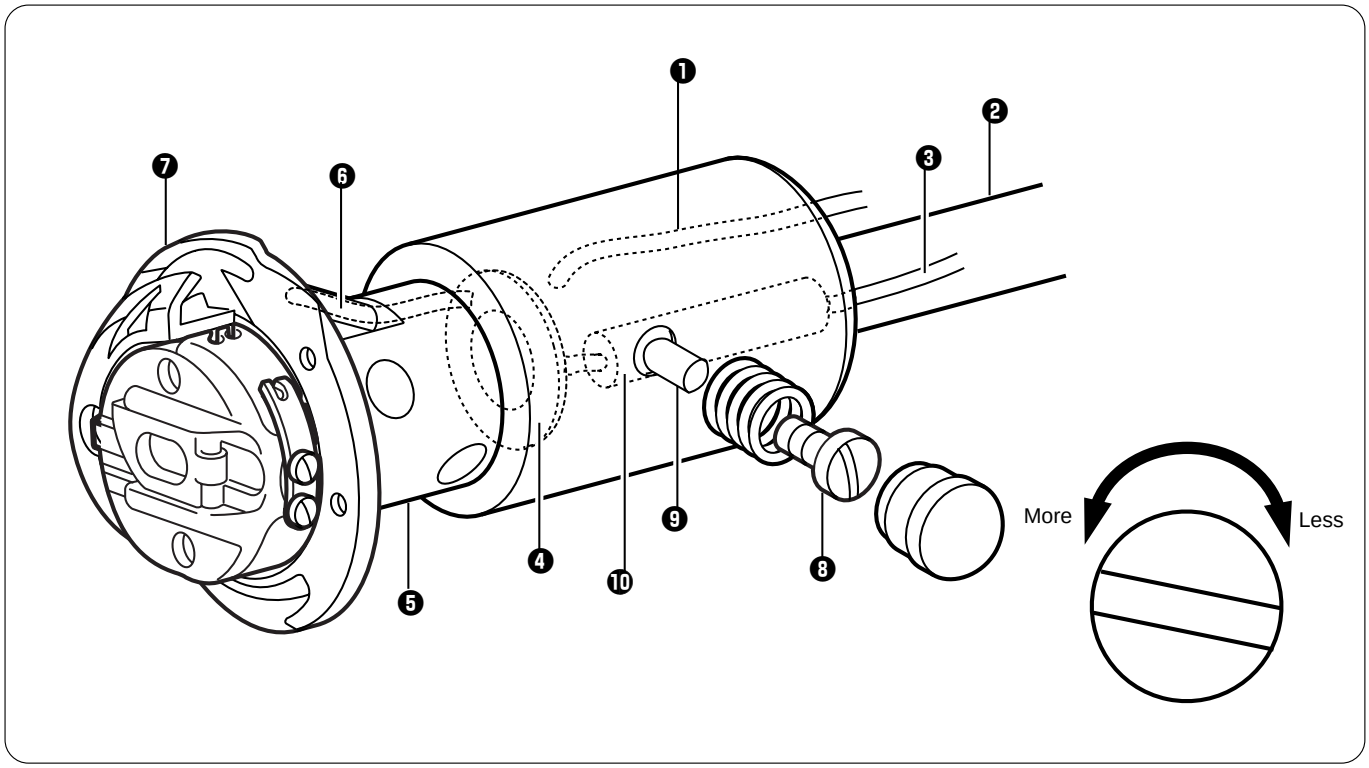
1. The cutter bar fixed plate assembly ❶ and the thread guide ❷ are secure to the thread breakage perceiving shaft ❸. When a thread breakage occurs, the cutter bar fixed plate assembly ❶ drop by its own weight and moves the thread guide ❷ in the direction of the arrow.
2. When the sensor ❹ detects the cutter bar fixed plate assembly ❶, the sewing machine stops and the cutter is prevented from dropping.

1-8. Lubrication mechanism



1. The plunger pump ❷ that is attached to the lower shaft ❶ draws oil up (A) through the pump filter ❸ and sends the oil (B) to the oil terminal ❹, where the wick lubricates the felt ❺.
2. The oil is transferred from the felt ❺ by means of the wick to the following places.
   1) Oil is supplied to bush F ❻, and it passes through the upper shaft ❼ and thread take-up crank ❽ to the needle bar crank ❾. Furthermore, oil is supplied from bush F ❻ to zigzag lever bush F ❿.
   2) Oil is supplied from the needle bar bracket support shaft ⓫ to the needle bar ⓬, and from there it is supplied to parts such as the needle bar clamp ⓭.
   3) Oil is supplied from the support shaft ⓮ to the thread take-up ⓯.
   4) Oil is supplied to bush M ⓰.
   5) Oil is supplied to zigzag lever bush R ⓱.
   6) Oil is supplied to the motor lever shaft ⓲, and from there it is supplied to the zigzag connecting rod shaft ⓳. (Oil which splatters inside the arm is collected by the felt ⓴ and is supplied to the crank rod guide ㉑ and to the slide block ㉒.)
3. The oil which is sent to the oil terminal ❹ is returned to the oil tank via the oil return tube (C).
4. The oil which collects in the jaw of the arm, is absorbed by the felt ㉓ and is drawn up by the plunger pump ❷ through the tube (D), and it is then returned to the oil tank (E) by the plunger pump ❷.

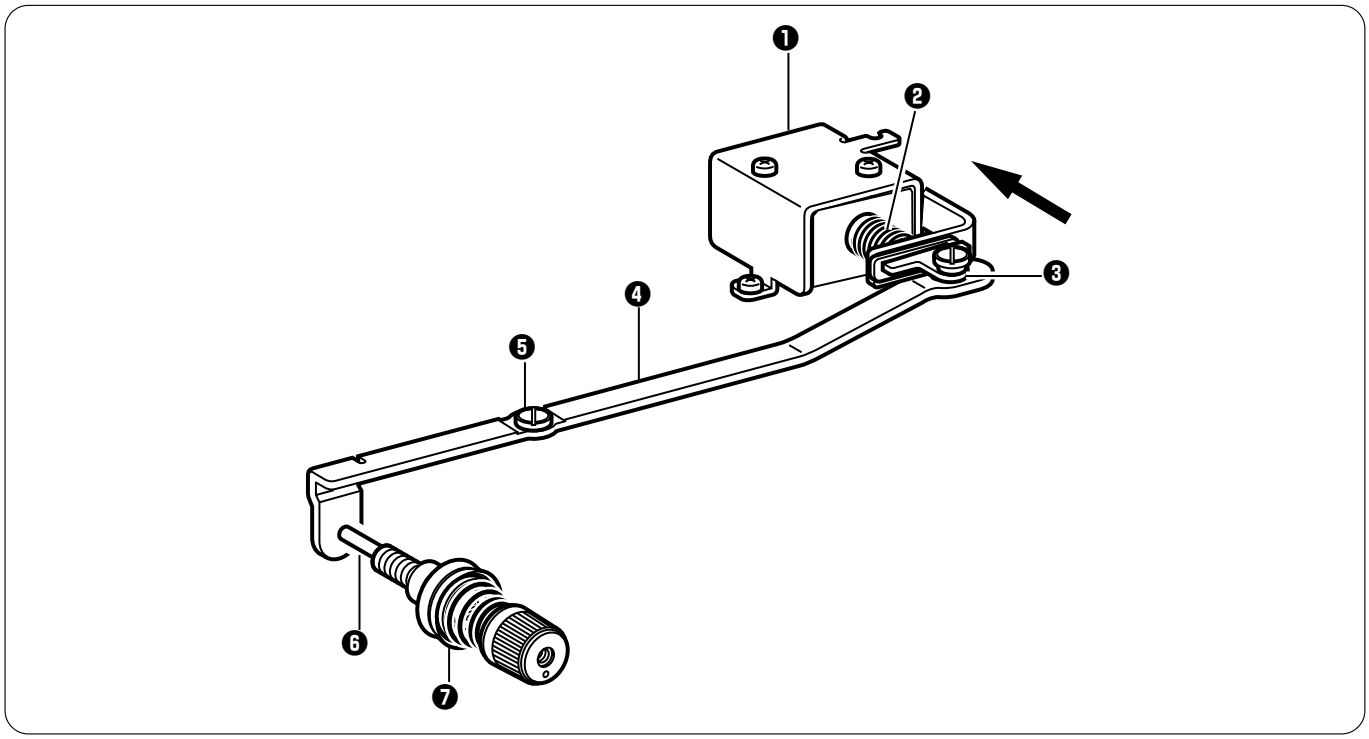
1-8-1. Lower shaft and rotary hook lubrication



1. The oil which is drawn up by the wick ❶ is supplied to the lower shaft ❷.
2. The oil which is drawn up by the wick ❸ passes through the felt ❹ and the rotary hook joint ❺ to the felt ❻, where it is supplied to the rotary hook ❼.
3. The oil that is supplied to the rotary hook ❼ can be adjusted by turning the screw ❽ to vary the amount by which the rubber presser ❾ presses down on the collar ❿ that the wick passes through.

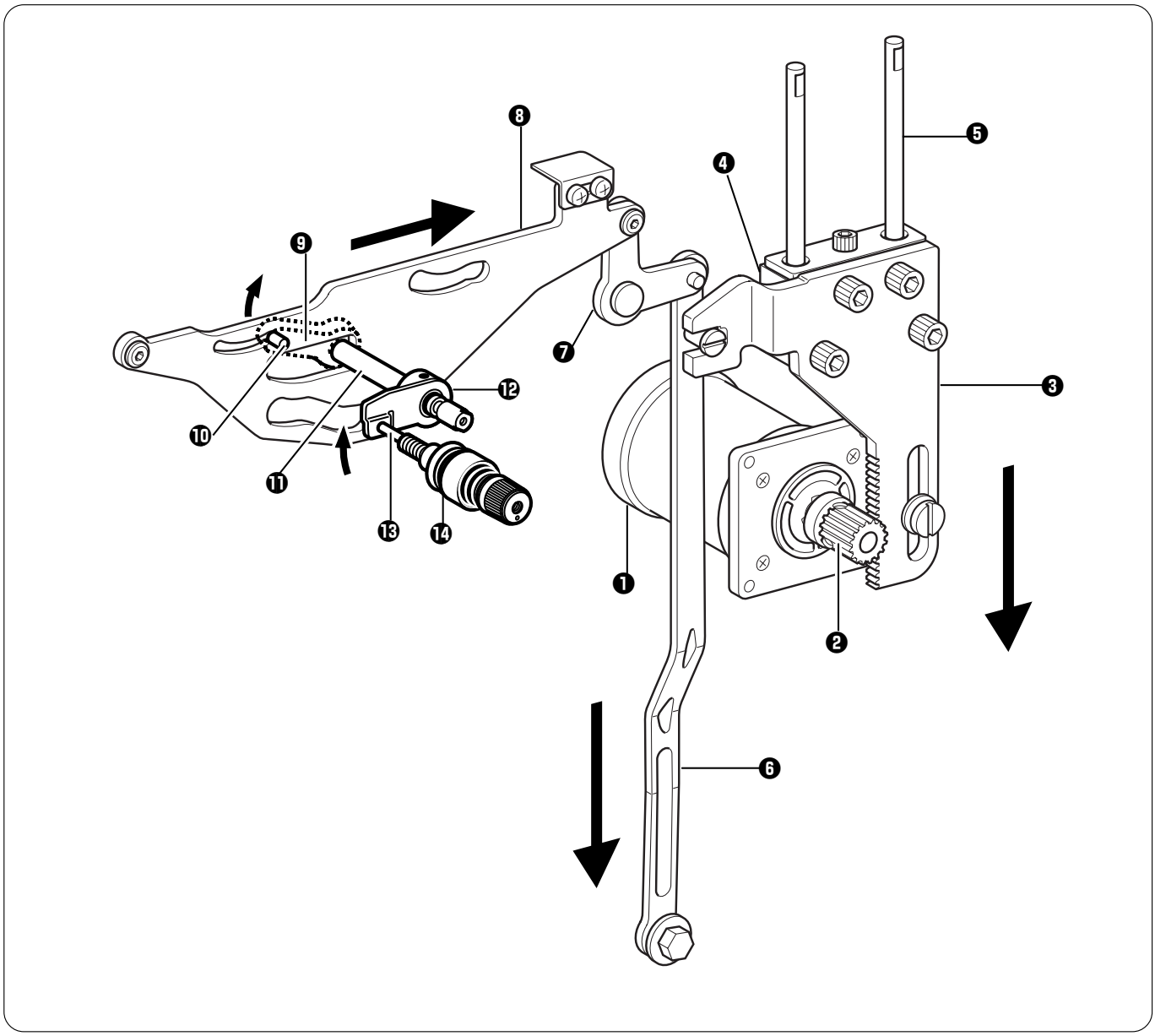
1-9. Tension release mechanism

[Zigzag tension control]



1. When a thread tension ON signal is input, the tension release solenoid ❶ operates.
2. The plunger ❷ moves in the direction of the arrow, and the movement is transmitted to the tension release solenoid link ❸ that is connected to the plunger ❷.
3. The tension release link ❹ that is connected to the tension release solenoid link ❸ operates with the shoulder screw ❺ as a pivot and presses against the tension release pin ❻.
4. The tension release pin ❻ presses against the tension disc presser ❼ to release the tension discs.

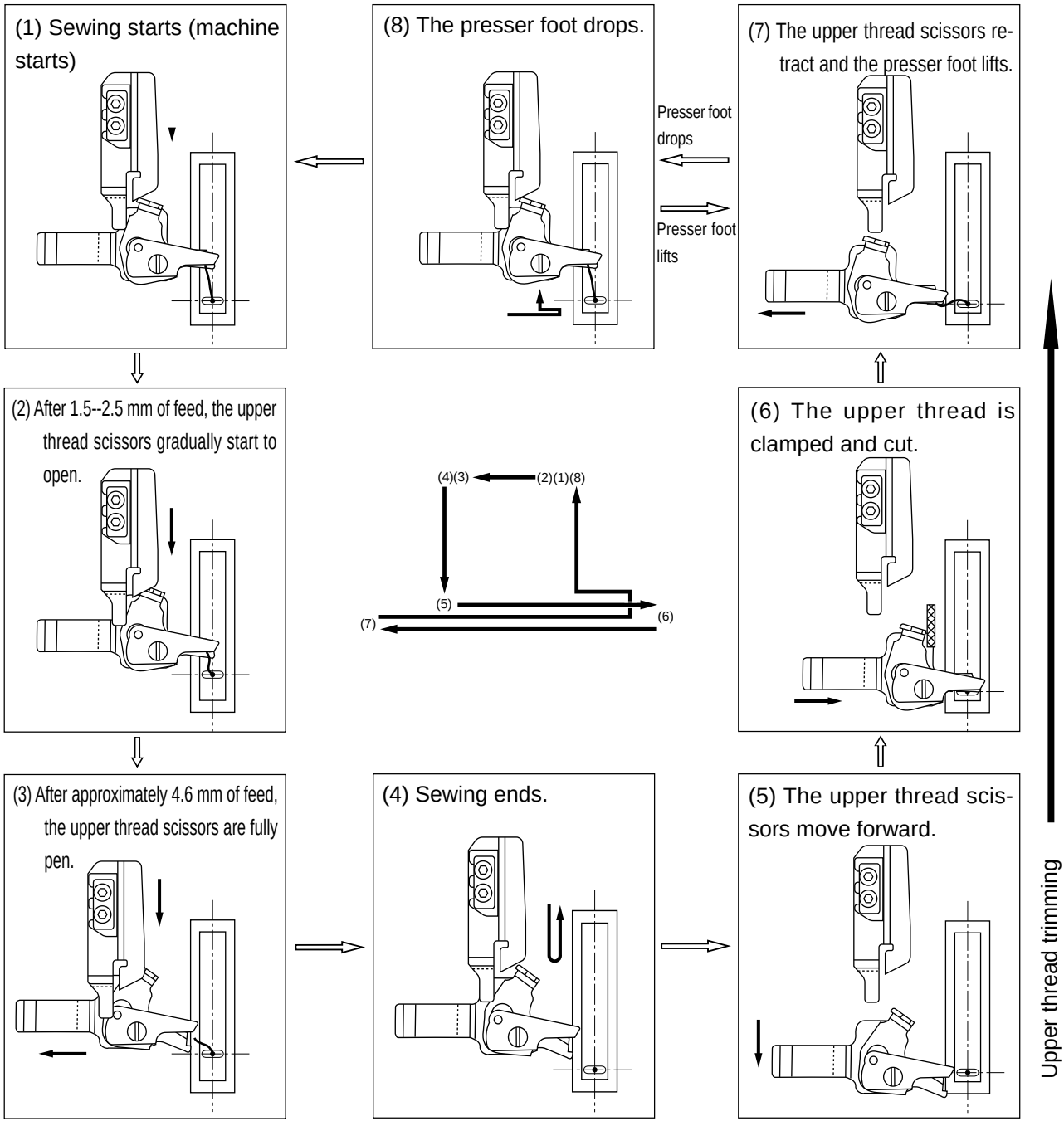
[Tack tension control]

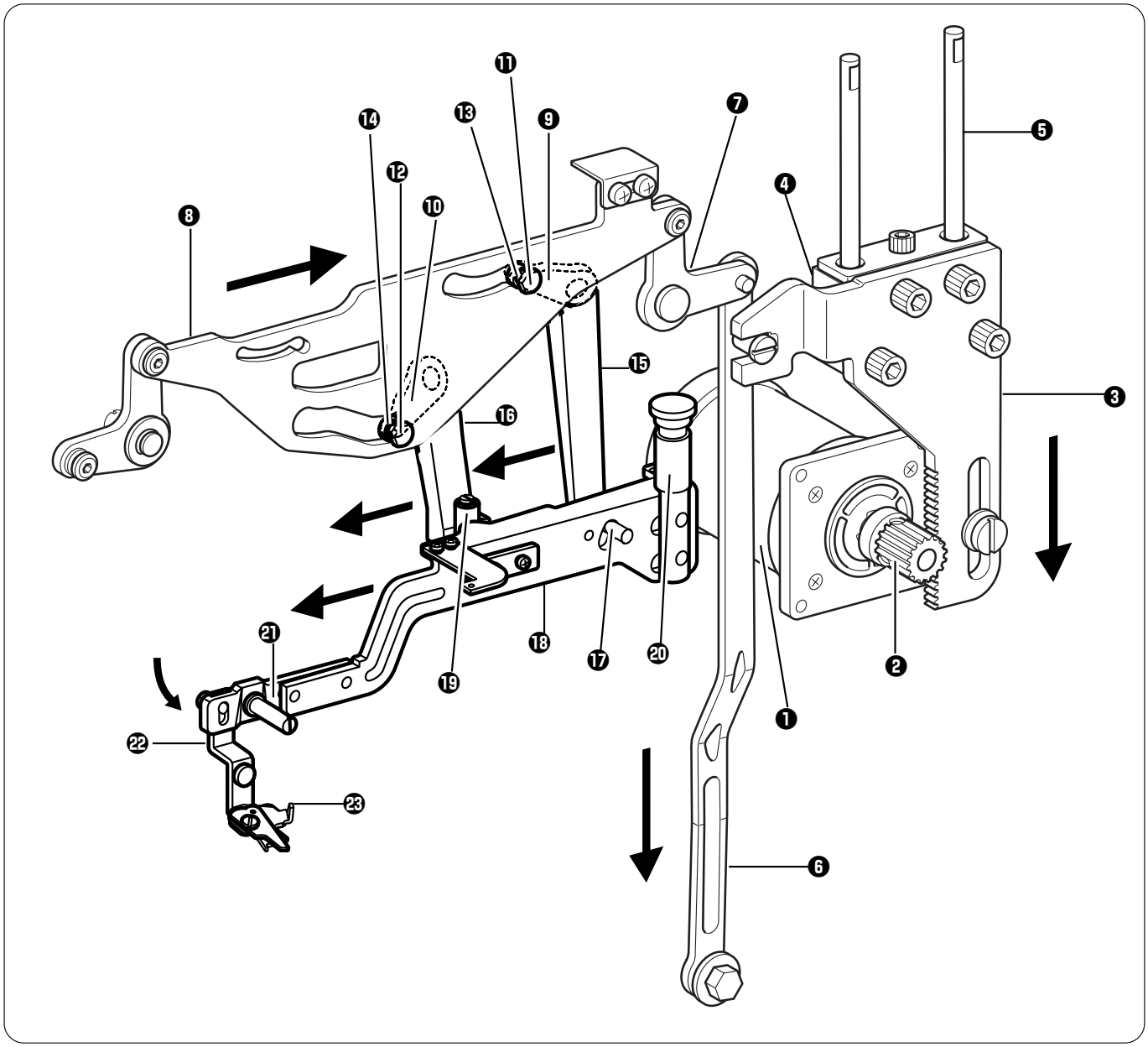


1. When the pulse motor ❶ operates, the gear ❷ that is installed to the pulse motor shaft engages with the presser driving arm ❸ so that the guide bracket ❹ moves along the guide shaft ❺ and moves the presser driving arm ❸ in the direction of the arrow.
2. The presser driving arm ❸ causes the presser foot lifter connecting rod ❻ to move in the direction of the arrow.
3. The movement of the presser foot lifter connecting rod ❻ is transmitted via the knee lifter lever ❼ to move the upper thread trimmer driving link ❽ in the direction of the arrow.
4. The needle roller ❿ that is secured to the end of the tension release driving lever ❾ is linked to the cam groove of the upper thread trimmer driving link ❽, so that when the upper thread trimmer driving link ❽ operates, the tension release driving lever ❾ that is secured to the tension release shaft ⓫ moves in the direction of the arrow.
5. The tension release cam ⓬ is secured to the end of the tension release shaft ⓫, and so the tension release cam ⓬ moves in the direction of the arrow.
6. When the tension release cam ⓬ presses against the tension release pin ⓭, the tension release pin ⓭ presses against the tension disc presser ⓮ to release the tension discs.

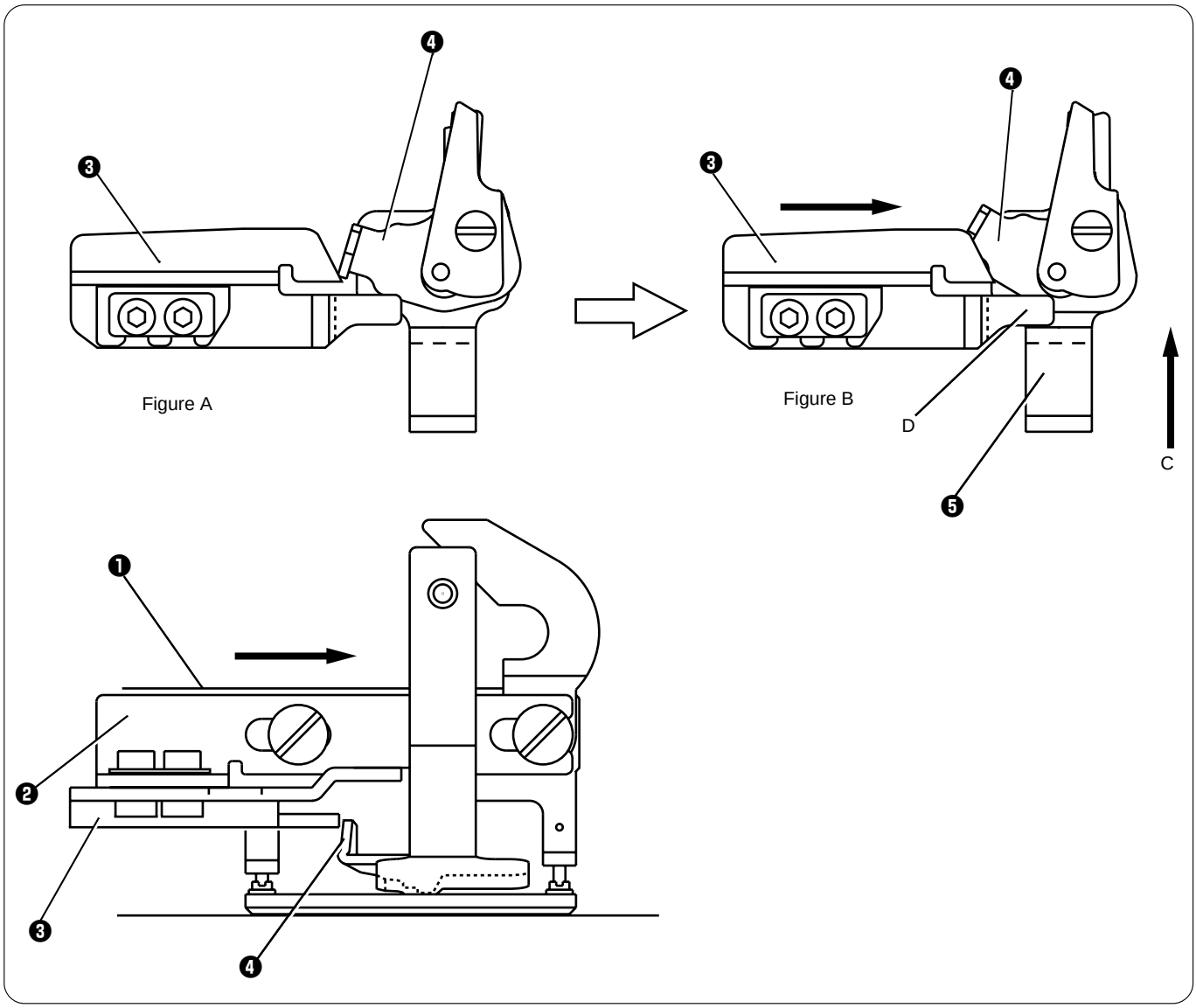
1-10. Upper thread trimmer mechanism

Upper thread trimmer mechanism operating sequence

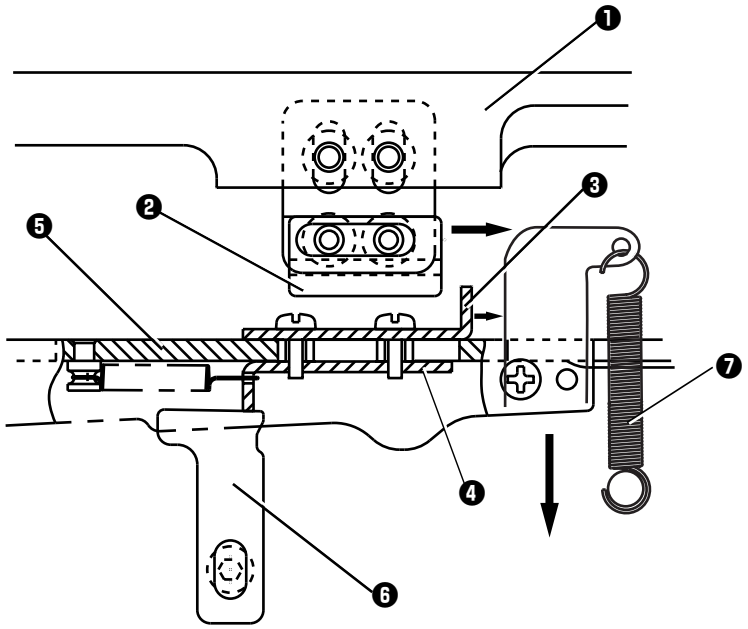

(1) Sewing starts (machine starts)
(8) The presser foot drops.
(7) The upper thread scissors retract and the presser foot lifts.
Presser foot drops
Presser foot lifts
(2) After 1.5--2.5 mm of feed, the upper thread scissors gradually start to open.
(4)(3)
(2)(1)(8)
(5)
(7)
(6)
(6) The upper thread is clamped and cut.
(3) After approximately 4.6 mm of feed, the upper thread scissors are fully pen.
(4) Sewing ends.
(5) The upper thread scissors move forward.
Upper thread trimming



1. When the pulse motor ❶ operates, the gear ❷ that is installed to the pulse motor shaft engages with the presser driving arm ❸ so that the guide bracket ❹ moves along the guide shaft ❺ and moves the presser driving arm ❸ in the direction of the arrow.
2. The presser driving arm ❸ causes the presser foot lifter connecting rod ❻ to move in the direction of the arrow.
3. The movement of the presser foot lifter connecting rod ❻ is transmitted via the knee lifter lever ❼ to move the upper thread trimmer driving link ❽ in the direction of the arrow.
4. The driving lever roller ⓭ and ball bearing ⓮ that are installed to the ends of the trimmer driving levers ❾ and ❿ by the shoulder screws ⓫ and ⓬ are linked to the cam groove in the upper thread trimmer driving link ❽ so that when the upper thread trimmer driving link ❽ moves in the direction of the arrow, the trimmer driving levers ❾ and ❿ operate.
5. When the trimmer driving levers ❾ and ❿ operate, the longitudinal feed arm ⓯ and trimmer driving arm ⓰ that are secured to the trimmer driving levers ❾ and ❿ move in the direction of the arrow.
6. When the longitudinal feed arm ⓯ operates, the upper thread trimmer lever ⓲ that is attached to the longitudinal feed arm roller ⓱ at the end of the longitudinal feed arm ⓯ moves back and forth.
7. When the trimmer driving arm ⓰ operates, the driving arm roller ⓳ that is installed to the trimmer driving arm ⓰ rolls along the cam groove in the upper thread trimmer lever ⓲, and the upper thread trimmer lever ⓲ rotates centering on the upper thread trimmer fulcrum shaft ⓴.
8. The setting plate ㉑ is secured to the end of the upper thread trimmer lever ⓲, and so the movement is transmitted to the upper thread trimmer assembly ㉒ that is secured to the setting plate ㉑.
9. Upper thread trimmer M ㉓ that is installed to the upper thread trimmer assembly ㉒ comes into contact with the work clamp, so that upper thread trimmer M ㉓ closes and cuts the thread.



1. An opening cam ❸ is attached to the opening cam bracket ❷ that is secured to the feed arm ❶ (Figure A). After sewing starts, the feed arm ❶ moves in the direction of the arrow (forward).
2. When upper thread trimmer M ❹ touches against the ridge line on the opening cam ❸, the upper thread trimmer gradually starts to open (Figure B). At this time, section D of the opening cam ❸ fits into the upper thread trimmer assembly ❺ so that the upper thread trimmer assembly ❺ cannot move in the direction of arrow C.



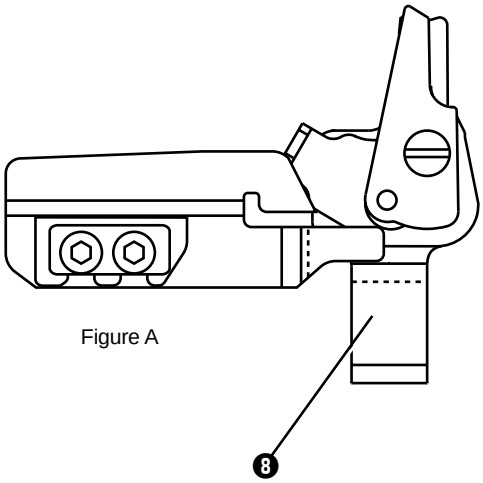


Figure A

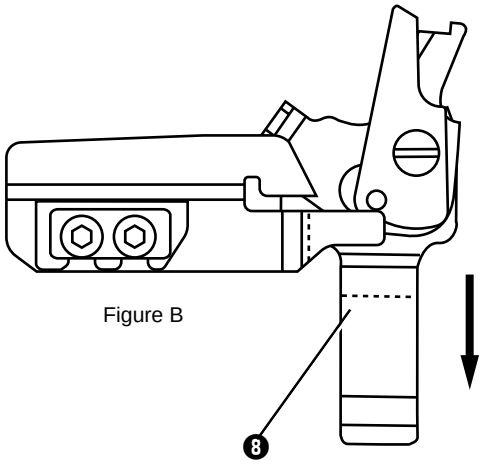
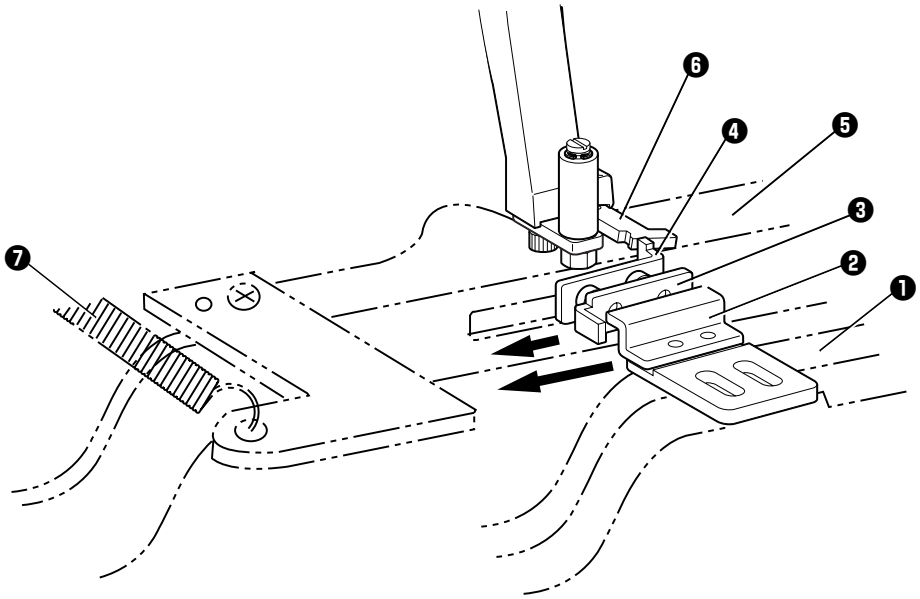
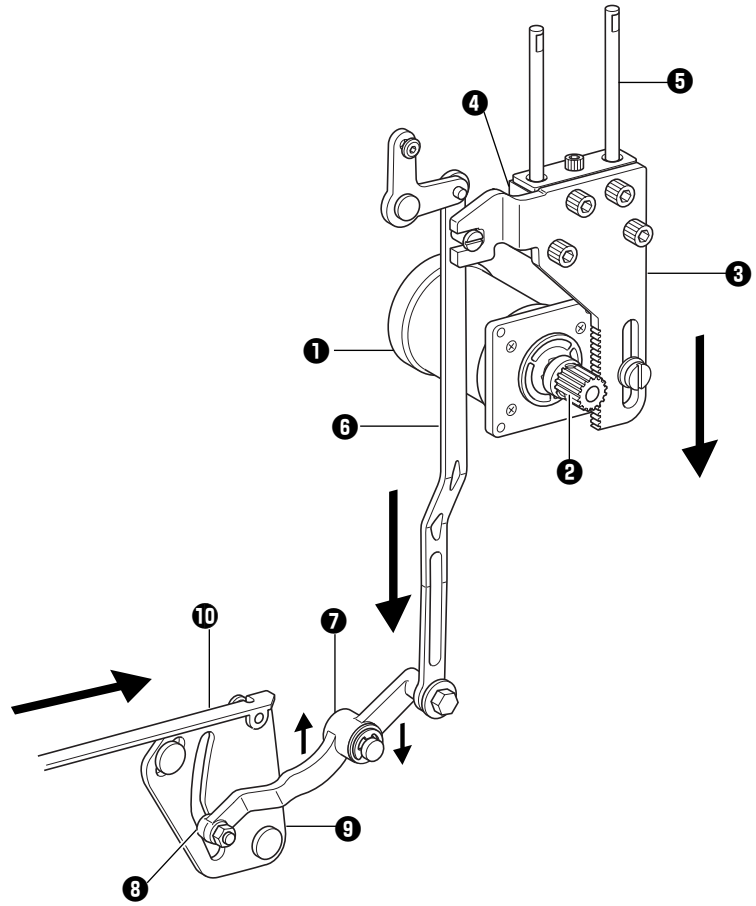


Figure B

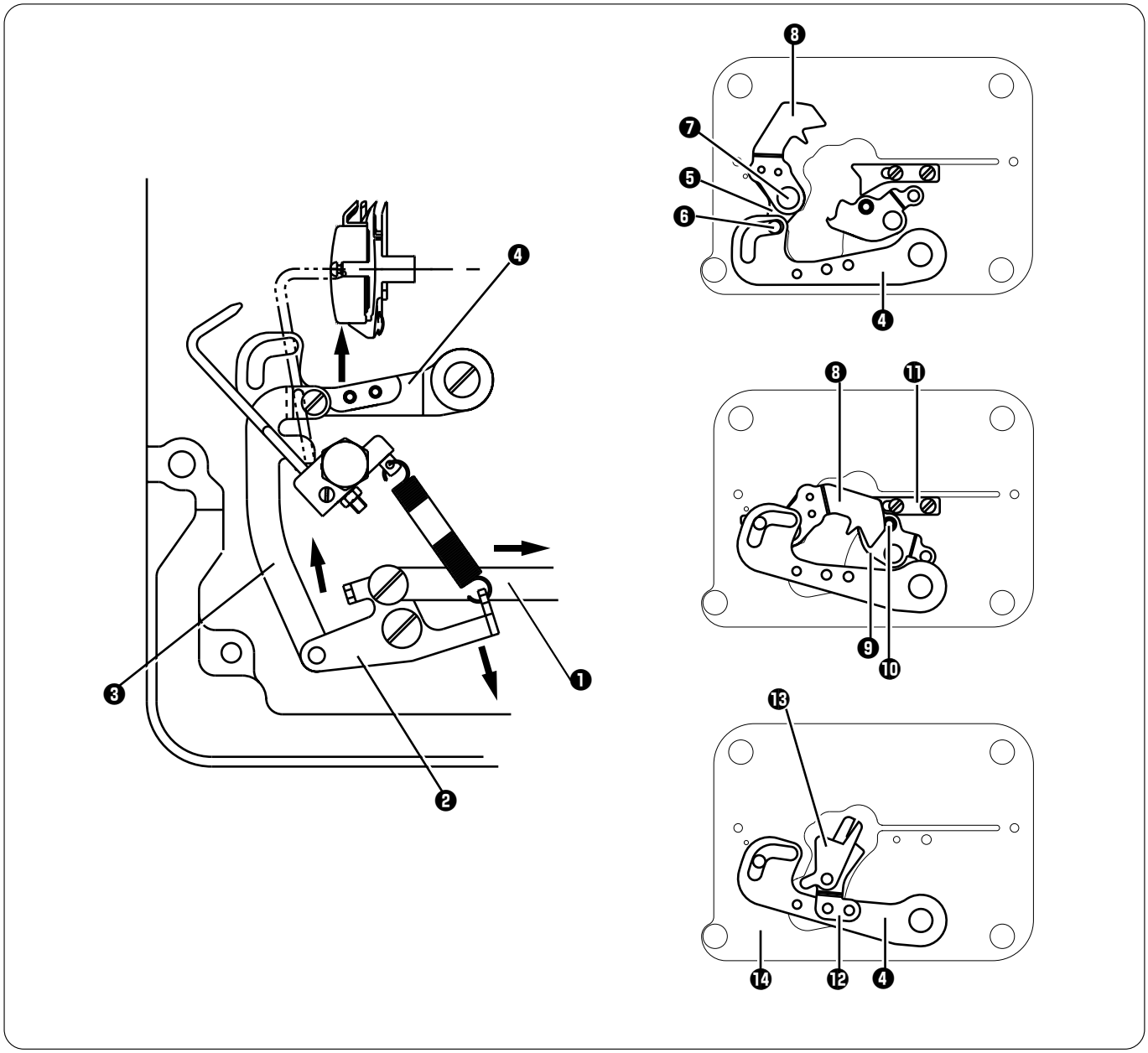


3. Then, when the feed mechanism moves forward, the cam ❷ that is secured to the feed arm ❶ moves in the direction of the arrow (forward) and moves the back plate ❸ in the direction of the arrow (forward).
4. When the back plate ❸ and the stop plate ❹ lock together and clamp the upper thread trimmer lever ❺ and the stop plate ❹ separates from the back stopper ❻, the upper thread trimmer lever ❺ is pulled in the direction of the arrow by the spring ❼, and the upper thread trimmer assembly ❽ changes from the condition in Figure A to the one in Figure B and the upper thread trimmer opens fully.

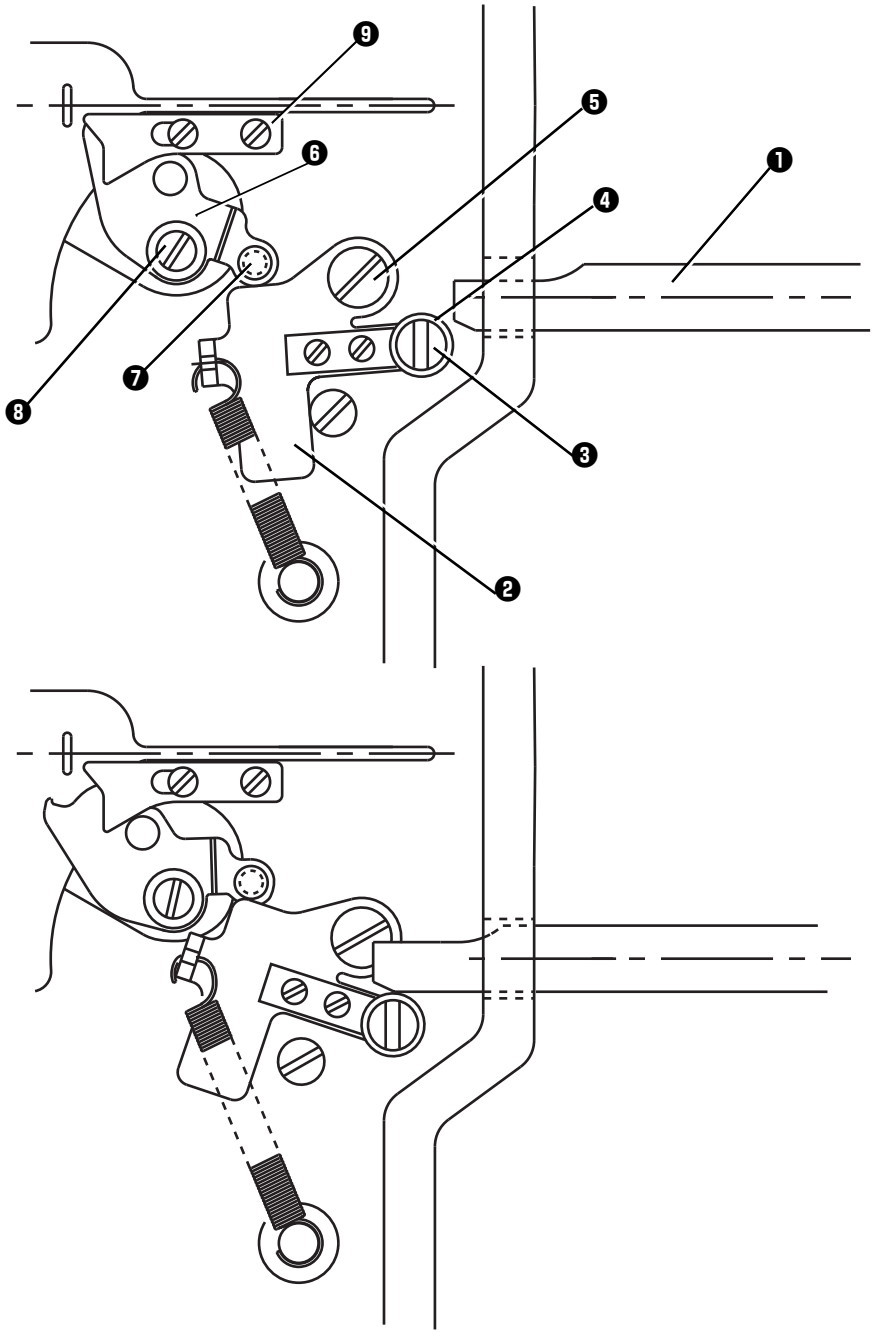
1-11. Lower thread trimmer mechanism



1. When the pulse motor ❶ operates, the gear ❷ that is installed to the pulse motor shaft engages with the presser driving arm ❸ so that the guide bracket ❹ moves along the guide shaft ❺ and moves the presser driving arm ❸ in the direction of the arrow.
2. The presser driving arm ❸ causes the presser foot lifter connecting rod ❻ to move in the direction of the arrow.
3. The presser foot lifter connecting rod ❻ is connected to the lower thread trimmer cam lever ❼, so that the lower thread trimmer cam lever ❼ moves.
4. The roller ❽ that is installed to the end of the lower thread trimmer cam lever ❼ is linked to the cam groove in the lower thread trimmer cam ❾, so that when the lower thread trimmer cam lever ❼ operates, the lower thread trimmer cam moves with it and the movement is transmitted to the lower thread trimmer cam connecting rod ❿ that is connected to the lower thread trimmer cam ❾.



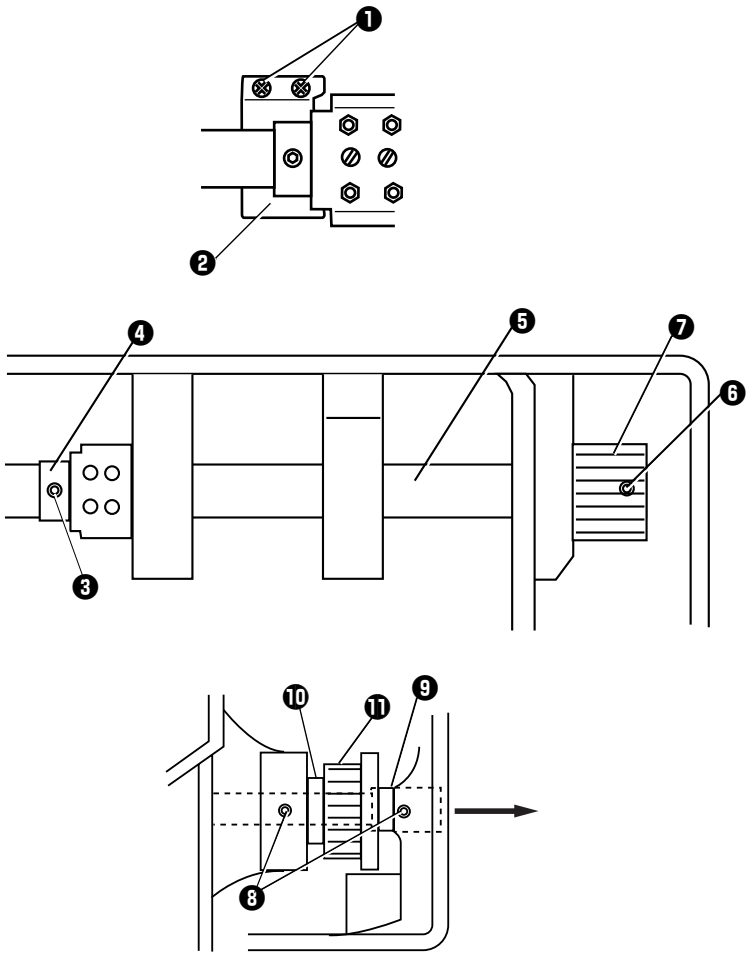
5. The lower thread trimmer cam connecting rod ❶ is connected to lower thread trimmer link A ❷, so that the movement of the lower thread trimmer cam connecting rod ❶ is transmitted via lower thread trimmer link A ❷ and the lower thread trimmer connecting rod ❸ to the knife driving lever ❹.
6. The collar ❻ that is installed to the lever ❺ is linked to the cam groove in the knife driving lever ❹, so that when the knife driving lever ❹ operates, the lever ❺ rotates centering on the screw ❼.
7. The lower thread retainer ❽ is secured to the lever ❺, so the lower thread retainer ❽ starts to operate.
8. When the lower thread retainer ❽ operates, the collar ❿ that is installed to the lower thread clamp plate ❾ moves over the ridge line of the cam of the lower thread retainer ❽, and the lower thread retainer ❽ starts to close and engages with the lower thread presser ⓫ so that the lower thread is clamped.
9. The lower thread retainer ❽ then continues operating.
10. The fixed knife ⓬ is secured to the knife driving lever ❹, so that when the knife driving lever ❹ operates, the cam section of the movable knife ⓭ that is secured to the fixed knife ⓬ moves over the cam section of the base plate ⓮ so that the movable knife ⓭ starts to close. When the lower thread retainer ❽ has finished operating, the movable knife ⓭ meshes fully with the fixed knife ⓬ and cuts the lower thread.



11. When feed guide shaft B ❶ that is secured to the feed arm support moves forward after sewing starts, the roller ❹ that is secured to the opening plate ❷ by means of the roller shaft ❸ moves over feed guide shaft B ❶ and the opening plate ❷ rotates centering on the shoulder screw ❺.
12. The opening plate ❷ presses against the collar ❼ that is installed to the lower thread clamp ❻ and the lower thread clamp ❻ rotates centering on the shoulder screw ❽, so that the clamped lower thread is released by the lower thread presser ❾ and the lower thread clamp ❻.

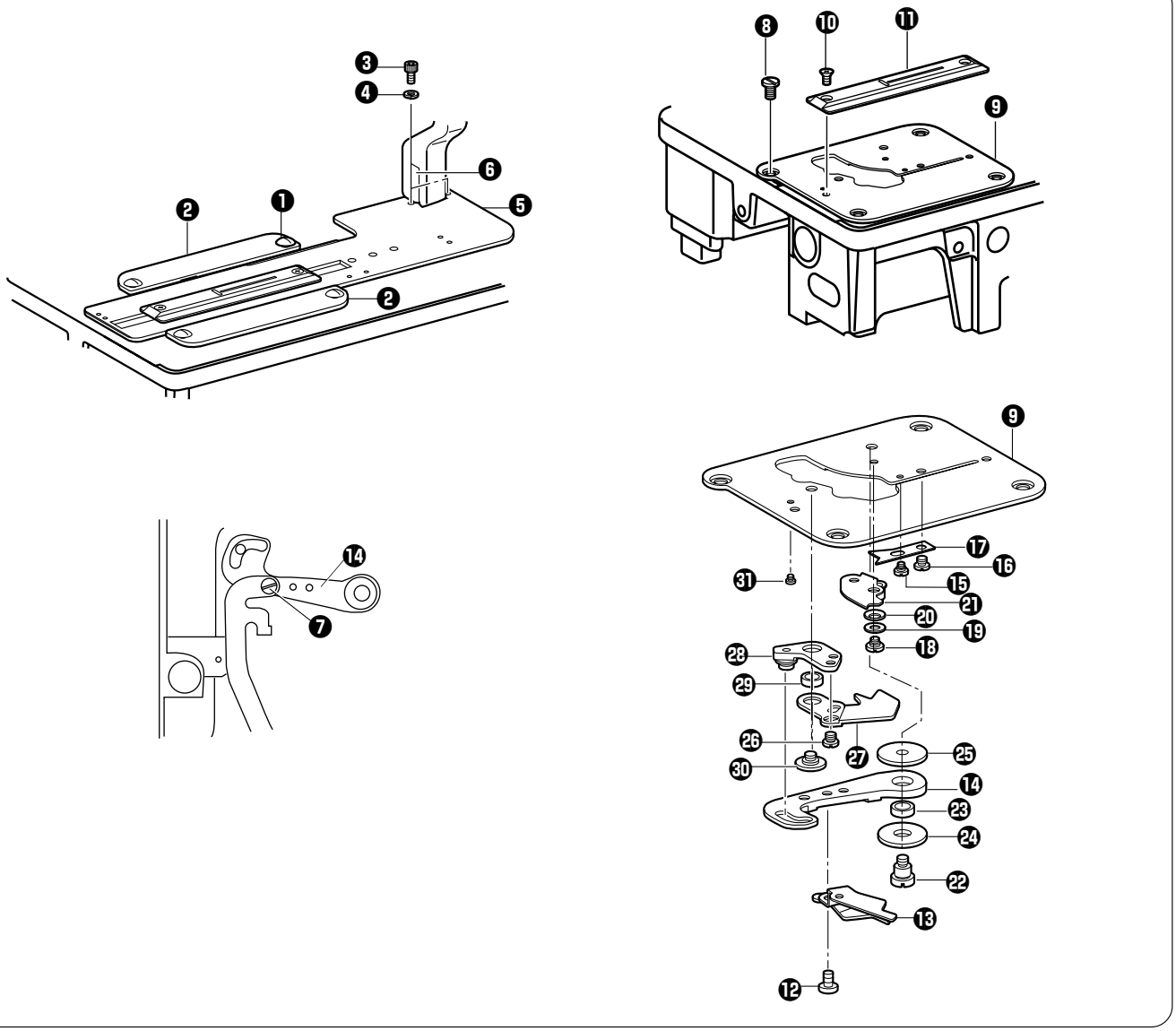
2. DISASSEMBLY

2-1. Lower shaft and idle pulley mechanism

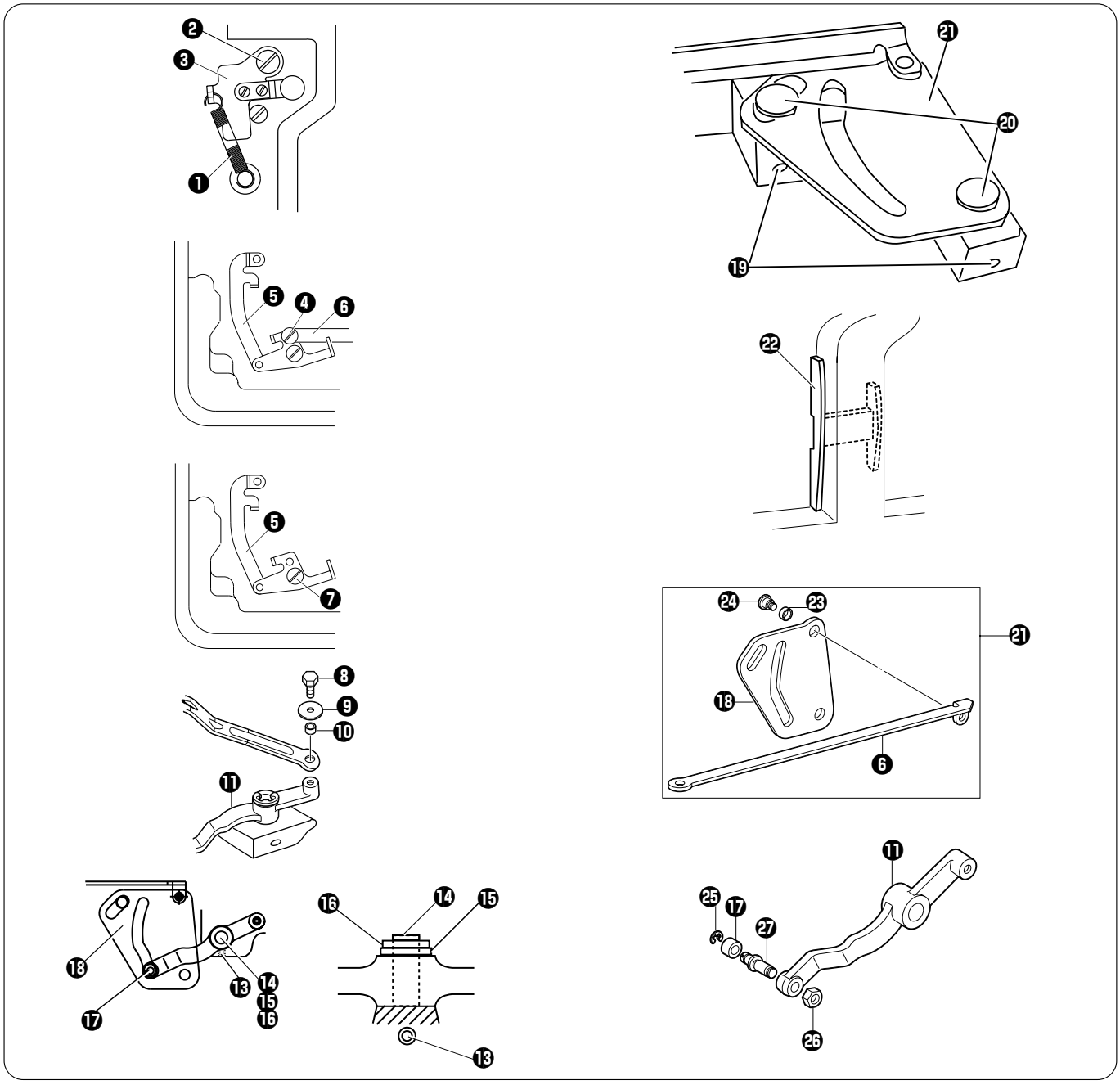


Remove the two screws ❶, and then remove the cover ❷.
Loosen the set screw ❸, and then remove the set screw collar assembly ❹ from the lower shaft ❺.
Loosen the set screw ❻, and then remove the timing pulley assembly ❼ from the lower shaft ❺.
Loosen the two set screws ❽, and then remove the shaft ❾.
Remove the collar ❿ and the idle pulley assembly ⓫.

2-2. Lower thread trimmer assembly



Remove the screw ❶, and then remove the feed presser plate ❷.
Remove the bolt ❸ and the washer ❹, and then remove the length feed plate ❺ from the feed arm support ❻.
Remove the shoulder screw 4.37 ❼.
Remove the four screws ❽, and then remove the base plate ❾.
Remove the pan screw ❿, and then remove the needle plate ⓫.
Remove the two screws ⓬, and then remove the fixed knife set ⓭ from the knife driving lever ⓮.
Remove the shoulder screw ⓯ and the screw ⓰, and then remove the lower thread presser ⓱ from the base plate ❾.
Remove the shoulder screw ⓲, plain washer ⓳ and spring washer ⓴, and then remove the lower thread clamp plate assembly ㉑ from the base plate ❾.
Remove the shoulder screw ㉒, collar ㉓, washer U ㉔ and washer D ㉕, and then remove the knife driving lever ⓮ from the base plate ❾.
Remove the two screws ㉖, and then remove the lower thread retainer ㉗ from the lever assembly ㉘.
Remove the collar ㉙ and the screw ㉚, and then remove the lever assembly ㉘ from the base plate ❾.
Remove the screw ㉛.



Remove the plate spring ❶.

Remove the shoulder screw ❷, and then remove the opening plate assembly ❸.

Remove the shoulder screw ❹.

Remove the shoulder screw ❼, and then remove the lower thread trimmer link assembly ❺.

Remove the bolt ❽, plain washer D ❾ and spacer ❿.

Loosen the set screw ⓭.

Remove the lower thread trimmer cam shaft ⓮, washer ⓯ and retaining ring ⓰.

Remove the lower thread trimmer cam lever ⓫.

Loosen the two set screws ⓳.

Remove the two lever shafts ⓴.

Remove the lower thread trimmer cam assembly ㉑ from the cover ㉒.

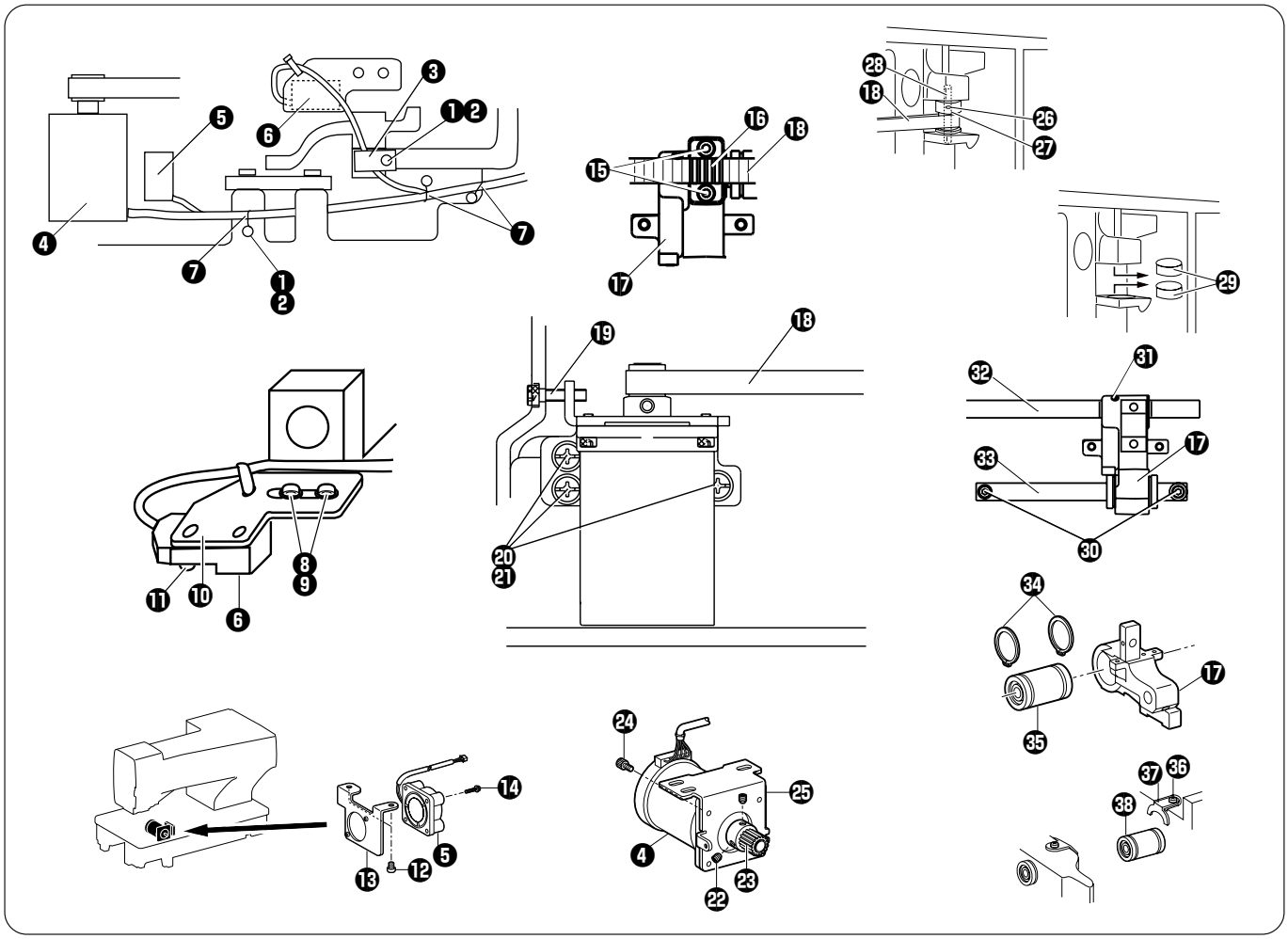
Remove the cover ㉒.

Remove the driving lever roller ㉓ and the shoulder screw ㉔, and then remove the lower thread trimmer cam connecting rod ❻ from the lower thread trimmer cam ⓲.

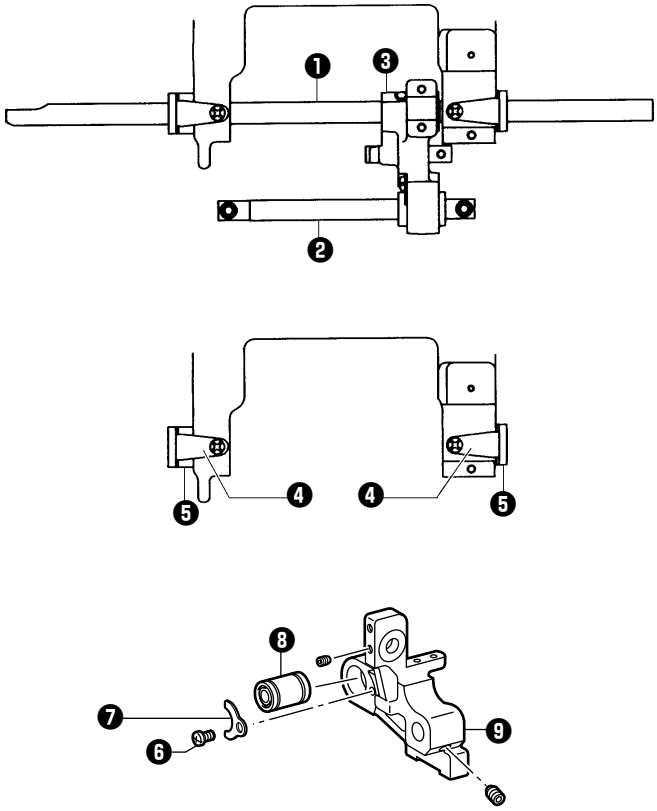
Remove the retaining ring ㉕, and then remove the roller ⓱.

Remove the nut ㉖, and then remove the roller shaft ㉗ from the lower thread trimmer cam lever ⓫.

2-3. Feed mechanism



Remove the screw ❶ and the plain washer ❷, and then remove the cord holder ❸ and the cord support ❼.
Disconnect the cords for the feed pulse motor ❹, DC fan motor 40 assembly ❺ and feed home position sensor ❻.
Remove the screw ❽ and the plain washer ❾, and then remove the feed sensor support plate ❿.
Remove the screw ⓫, and then remove the feed home position sensor ❻ from the feed sensor support plate ❿.
Remove the screw ⓬, and then remove the feed motor cover ⓭.
Remove the two screws ⓮, and then remove the DC fan motor 40 assembly ❺ from the feed motor cover ⓭.
Remove the two bolts ⓯, and then remove the belt holder ⓰ from the feed arm support ⓱.
Loosen the bolt ⓳.
Remove the three screws ⓴ and the three plain washers ㉑.
Loosen the two set screws ㉒, and then remove the pulley A assembly ㉓.
Remove the four bolts ㉔, and then remove the motor mounting bracket ㉕ from the feed pulse motor ❹.
Loosen the set screw ㉖, and then remove the support shaft ㉘.
Remove the timing belt ⓲ and the pulley B assembly ㉗.
Remove the two ball bearings (688ZZNR) ㉙.
Loosen the set screw ㉛, and then remove feed guide shaft B ㉜ from the feed arm support ⓱.
Remove the two bolts ㉚.
Remove the feed arm support ⓱ and feed guide shaft A ㉝.
Remove the two retaining rings ㉞, and then remove the linear bush ㉟ from the feed arm support ⓱.
Remove the screw ㊱, and then remove the ball bearing stopper ㊲.
Remove the two feed shaft linear bushes ㊳.



For long-hole specifications (-5)

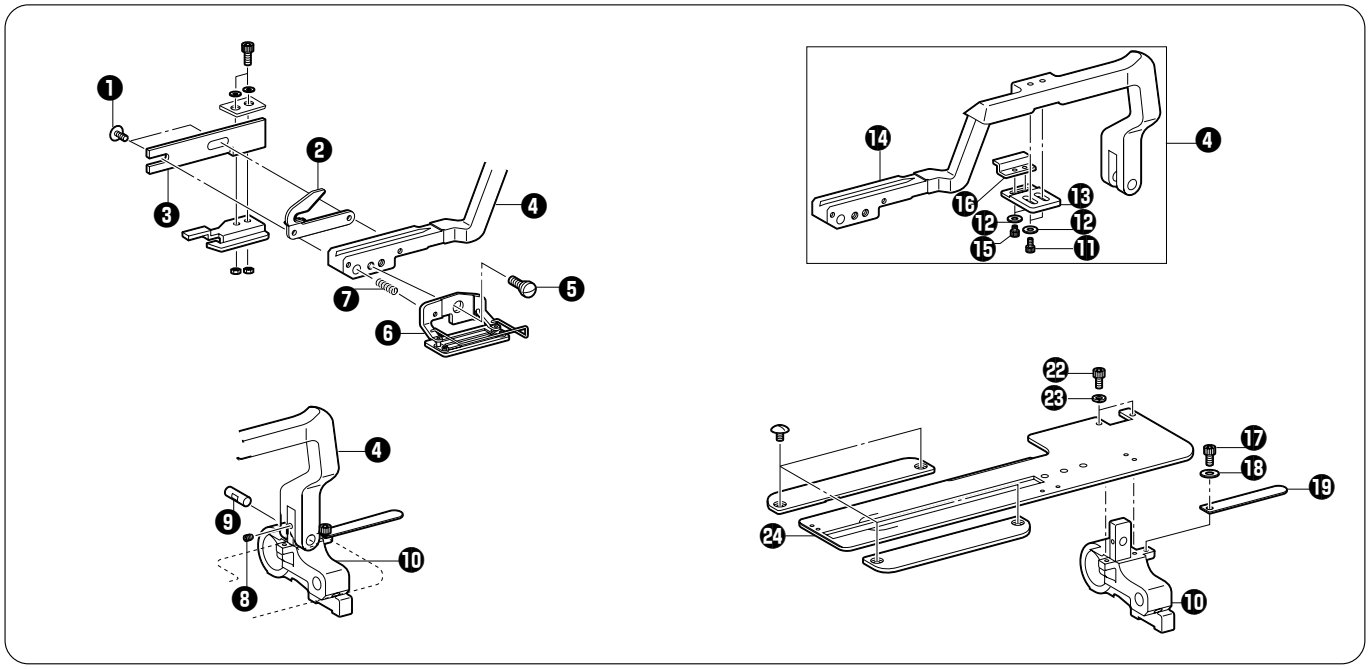
Remove feed guide shaft B-5 (for long-hole) ❶.

Remove feed guide shaft A-5 (for long-hole) ❷ and feed arm support -5 (for long-hole) ❸.

Remove the two ball bearing stoppers B (for long-hole) ❹, and then remove the two linear bushes ❺.

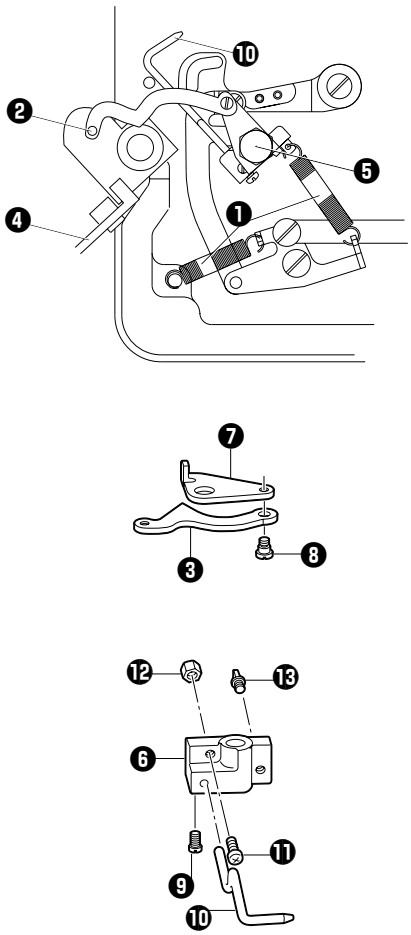
Remove the screw ❻, and then remove the linear bush stopper plate (for long-hole) ❼.

Remove the linear bush 9.53 (for long-hole) ❽ from the feed arm support -5 (for long-hole) ❾.



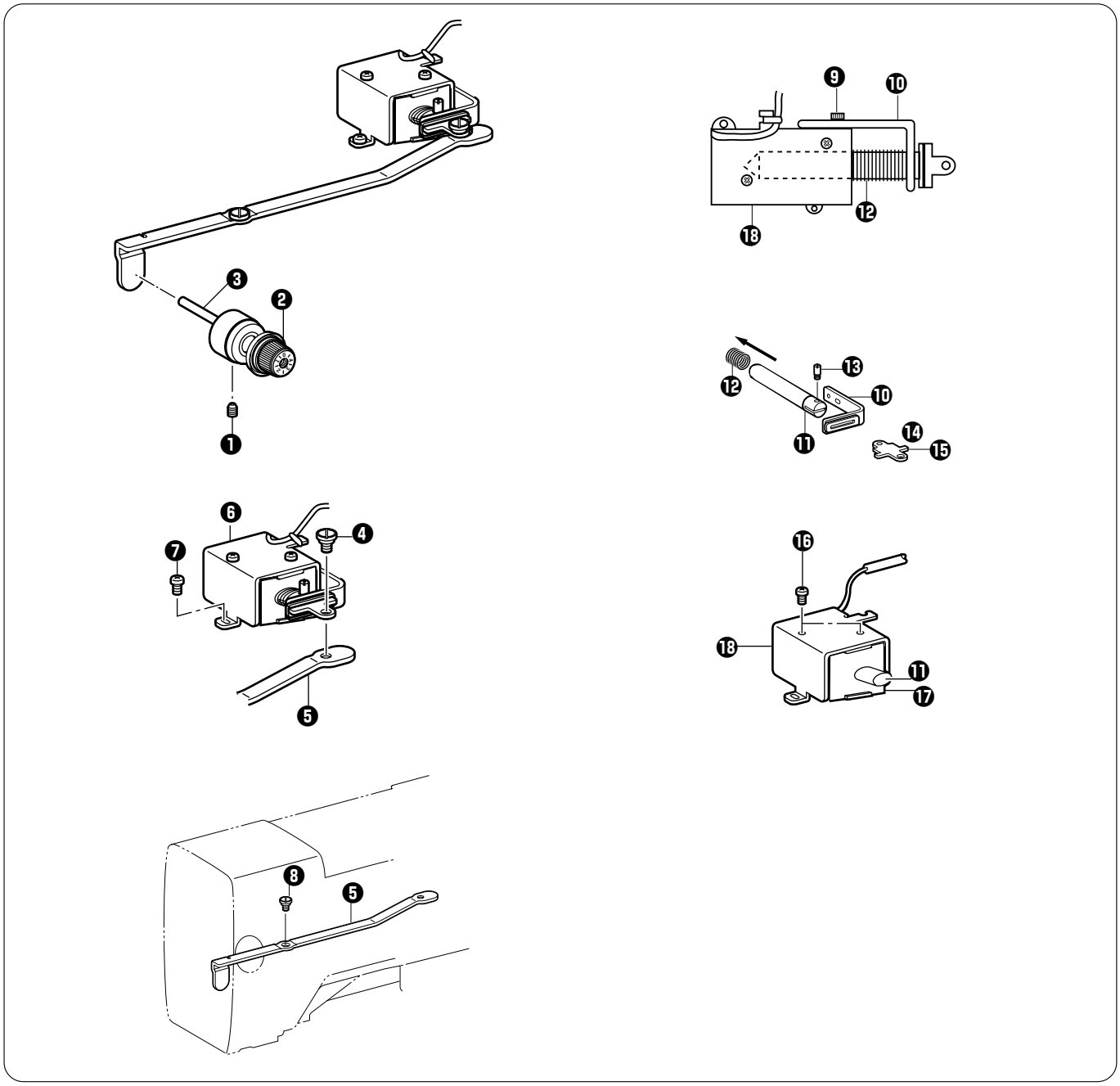
Remove the two screws ❶, and then remove the feed arm support ❷ and the opening cam assembly ❸ from the feed arm assembly ❹.
Remove the shoulder screw ❺, and then remove the work clamp ❻ and the spring ❼ from the feed arm assembly ❹.
Loosen the set screw ❽, and then remove the feed arm assembly ❹ and feed arm support shaft ❾ from the feed arm support ❿.
Remove the two eye bolts ⓫ and the two plain washers ⓬, and then remove the support plate ⓭ from the feed arm ⓮.
Remove the two eye bolts ⓯ and the two plain washers ⓬, and then remove the cam ⓰ from the support plate ⓭.
Remove the eye bolt ⓱ and the flat washer ⓲, and then remove the feed cover ⓳ from the feed arm support ❿.
Remove the two eye bolts ㉒ and the two spring washers ㉓, and then remove the length feed plate ㉔ from the feed arm support ❿.

2-4. Bobbin presser mechanism



Remove the two extension springs ❶.
Remove the shoulder screw ❷, and then remove the opening plate ❸ from the rotary hook cover ❹.
Remove the shoulder screw ❺, and then remove the bobbin presser bracket ❻ and the auxiliary plate ❼.
Remove the shoulder screw ❽, and then remove the auxiliary plate ❼ and the opening plate ❸.
Loosen the set screw ❾, and then remove the bobbin presser ❿ from the bobbin presser bracket ❻.
Remove the screw ⓫ and the nut ⓬.
Remove spring hook U ⓭.

2-5. Tension release mechanism



Loosen the screw ❶.

Remove the tension stud bracket assembly ❷ and the tension release pin ❸.

Remove the shoulder screw ❹.

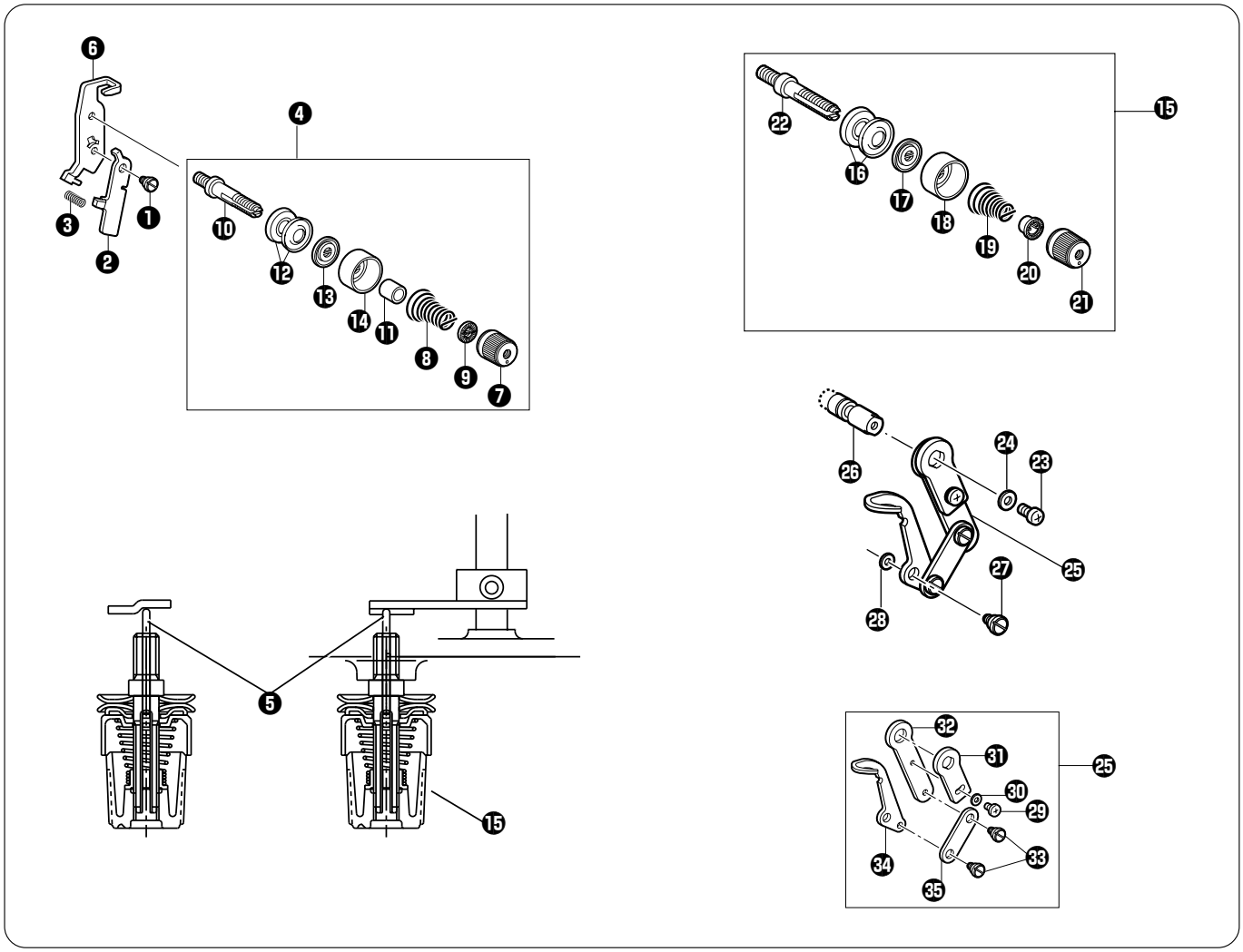
Remove the two screws ❼, and then remove the tension release solenoid assembly ❻.

Remove the shoulder screw ❽, and then remove the tension release link ❺.

Remove the bolt ❾, and then remove the plate ❿, plunger ⓫ and spring ⓬.

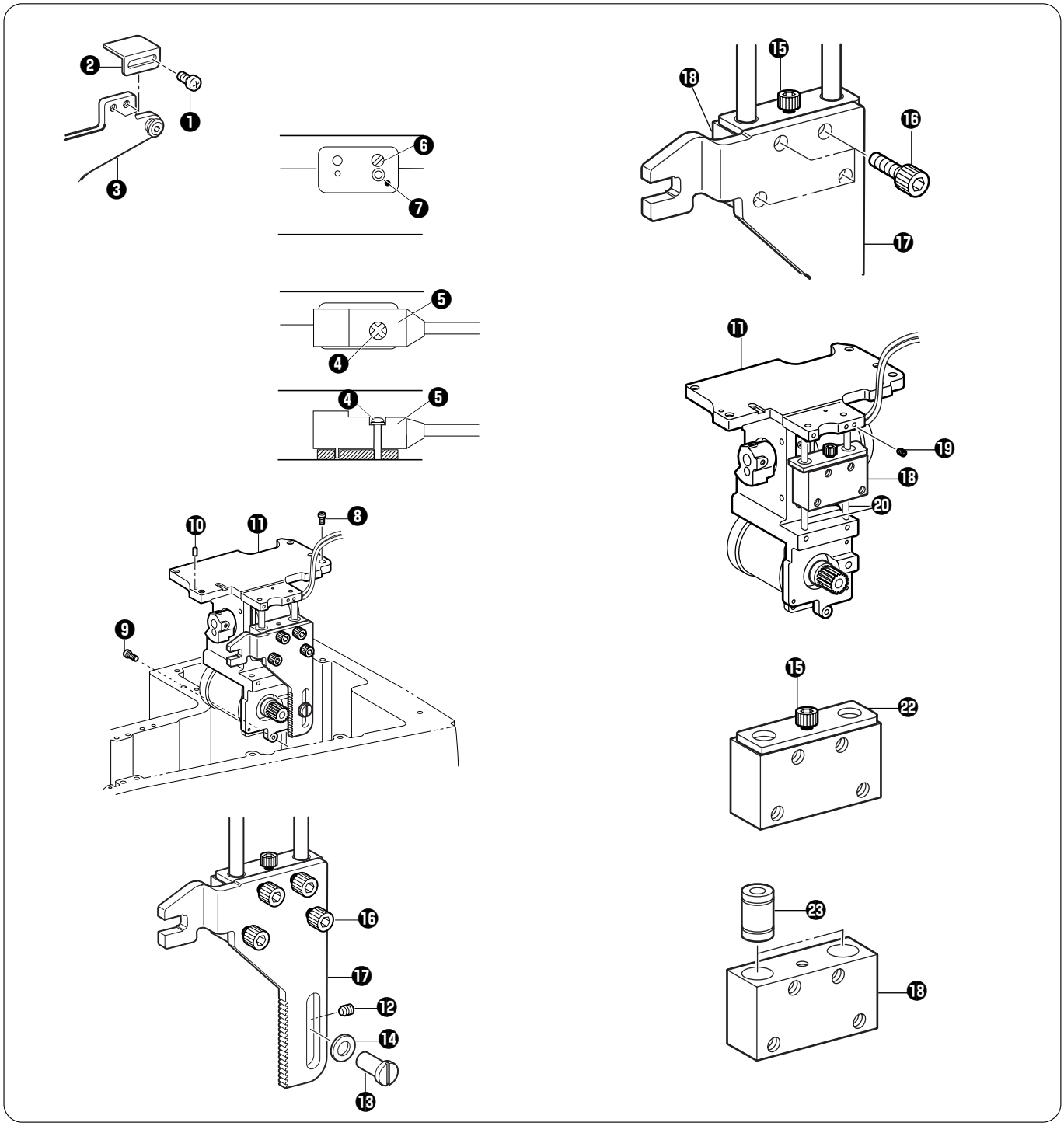
Remove the plunger pin ⓭, and then remove the plunger ⓫ and the tension release solenoid link ⓯.

Remove the two screws ⓰, and then remove the tension release solenoid ⓱ from the solenoid holder ⓲.

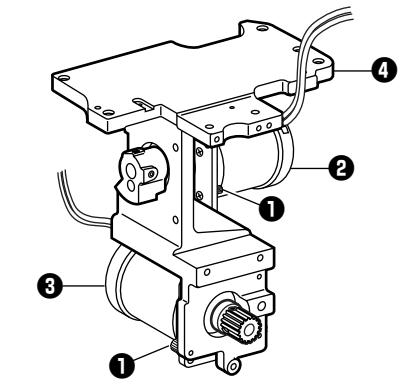


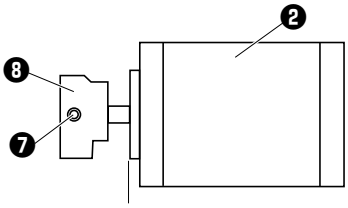
Remove the shoulder screw ❶, and then remove the tension release lever ❷ and the spring ❸.
Remove the tension stud assembly ❹ from the tension release lever bracket ❻.
Remove the tension nut ❼, and then remove the spring ❽ and washer ❾ from the tension stud ❿.
Remove the collar ⓫, and then remove the tension discs ⓬, tension disc presser ⓭ and tension disc presser ⓮ from the tension stud ❿.
Remove the sub thread tension assembly ⓯ and tension release pin ⓰ from the arm.
Remove the two tension discs ⓰, tension disc presser ⓱, tension disc presser ⓲, tension adjusting spring ⓳, washer ⓴ and tension nut ㉑ from the sub tension stud ㉒.
Remove the screw ㉓ and the washer ㉔, and then remove the thread take-up lever assembly ㉕ from the tension release shaft ㉖.
Remove the shoulder screw ㉗, and then remove the washer ㉘ from the arm.
Remove the shoulder screw ㉙ and the washer ㉚, and then remove the lever ㉛ from the adjusting lever ㉜.
Remove the two shoulder screws ㉝, and then remove the adjusting lever ㉜ and the tension take-up lever ㉞ from the lever link ㉟.

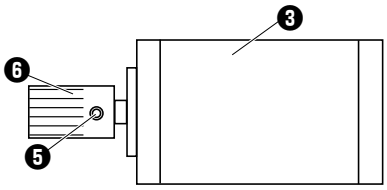
2-6. Presser lifter mechanism



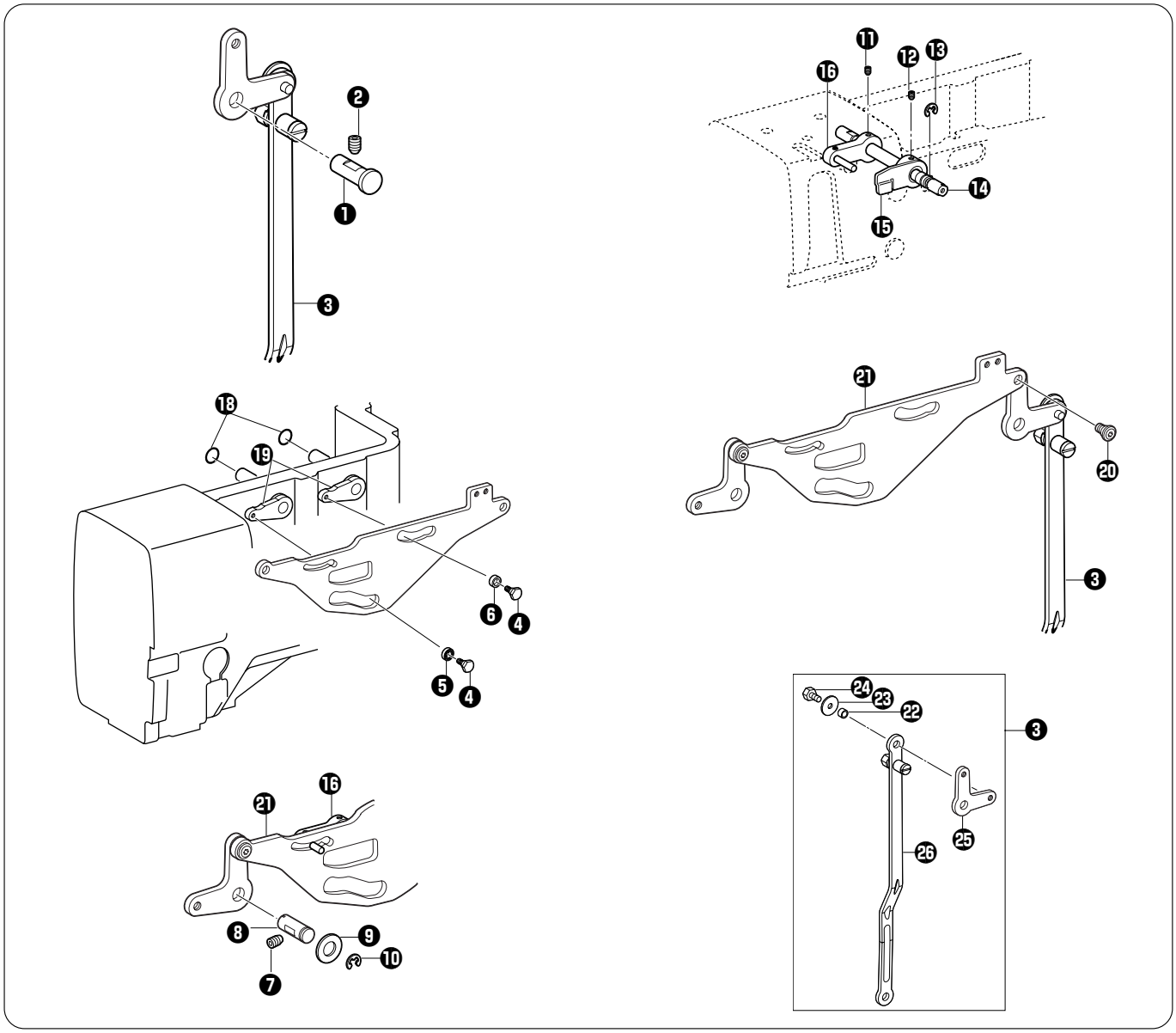
Remove the two screws ❶, and then remove the clamp sensor dog ❷ from the upper thread trimmer driving link ❸.
Remove the screw ❹, and then remove the sensor ❺.
Remove the pan screw ❻, and then remove the clamp sensor plate ❼.
[Remove the zigzag connecting rod while referring to "Needle zigzag mechanism".]
Remove the four screws ❽ and the screw ❾.
Remove the two positioning pins ❿.
Remove the motor bracket assembly ⓫ from the top of the arm.
Loosen the set screw ⓬, and then remove the driving arm presser ⓭ and the washer ⓮.
Remove the four bolts ⓰, and then remove the presser driving arm ⓱ from the guide bracket ⓲.
Loosen the four set screws ⓳, and then remove the two guide shafts ⓴ and the guide bracket ⓲.
Remove the bolt ⓯, and then remove the bearing holder ㉑.
Remove the two linear ball bearings ㉒ from the guide bracket ⓲.







Remove the bolt ❶, and then remove the pulse motor N assembly (for needle zigzag) ❷ and the pulse motor FT assembly (for presser lifter) ❸ from the motor bracket ❹.
Remove the set screw ❺, and then remove the gear 15.75 ❻ from the pulse motor FT assembly (for presser lifter) ❸.
Remove the set screw ❼, and then remove the motor lever ❽ from the pulse motor N assembly (for needle zigzag) ❷.



Loosen the eye bolt ❷, and then remove lifter shaft A ❶.

Remove the shoulder screw ❹, and then remove the ball bearing ❺ and the driving lever roller ❻.

Remove the set screw ❼.

Remove the lifter shaft ❽, small plain washer 8 ❾ and retaining ring E6 ❿.

Loosen the set screws ⓫ and ⓬.

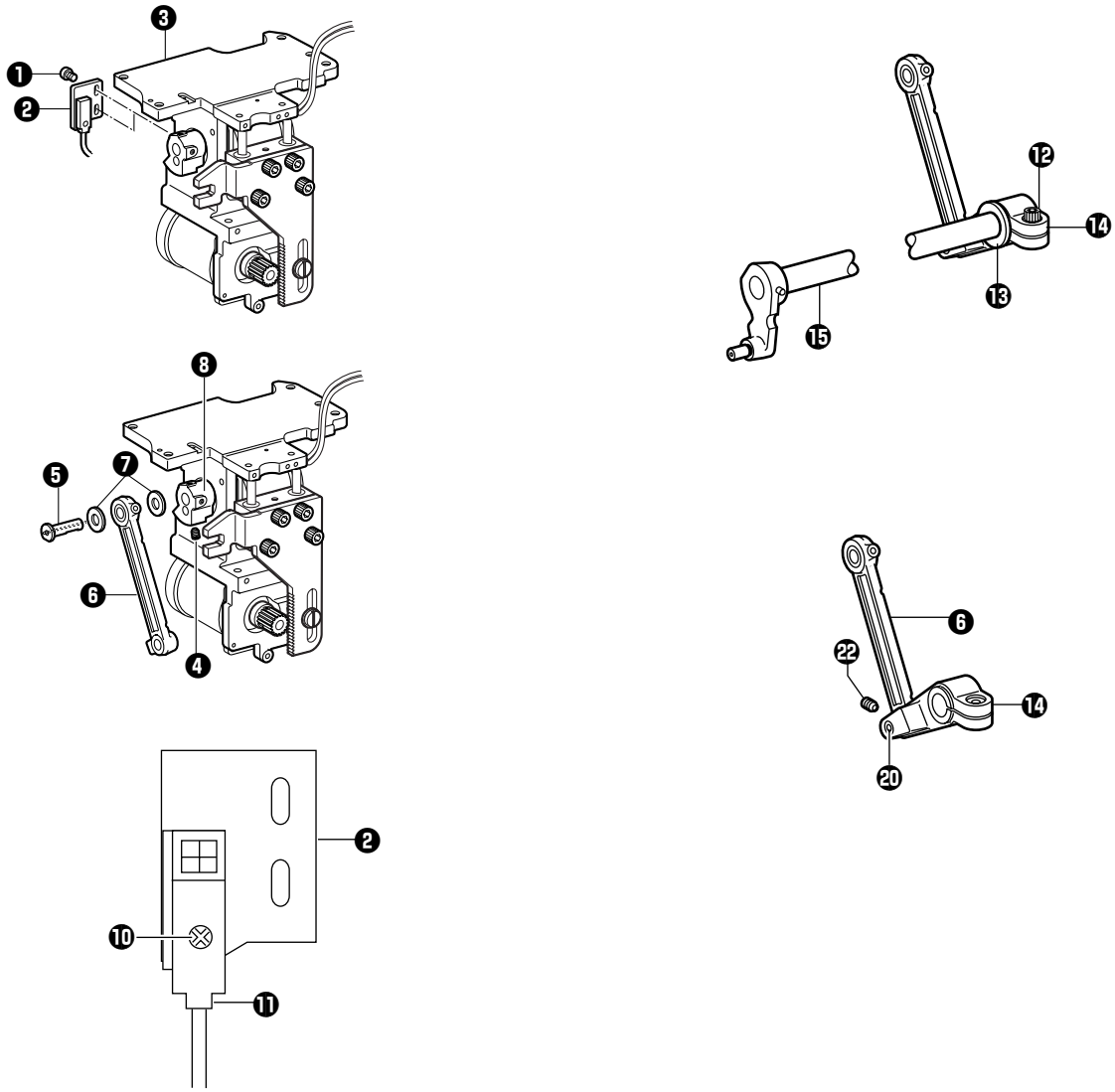
Remove the retaining ring ⓭, and then remove the tension release shaft ⓮, tension release cam ⓯ and tension release driving lever ⓰.

Remove the shoulder screw ⓴, and then remove the presser lifter connecting rod set ❸ and the lifter shaft assembly ㉑.

Remove the two O-rings ⓲ and the two trimmer driving levers ⓳.

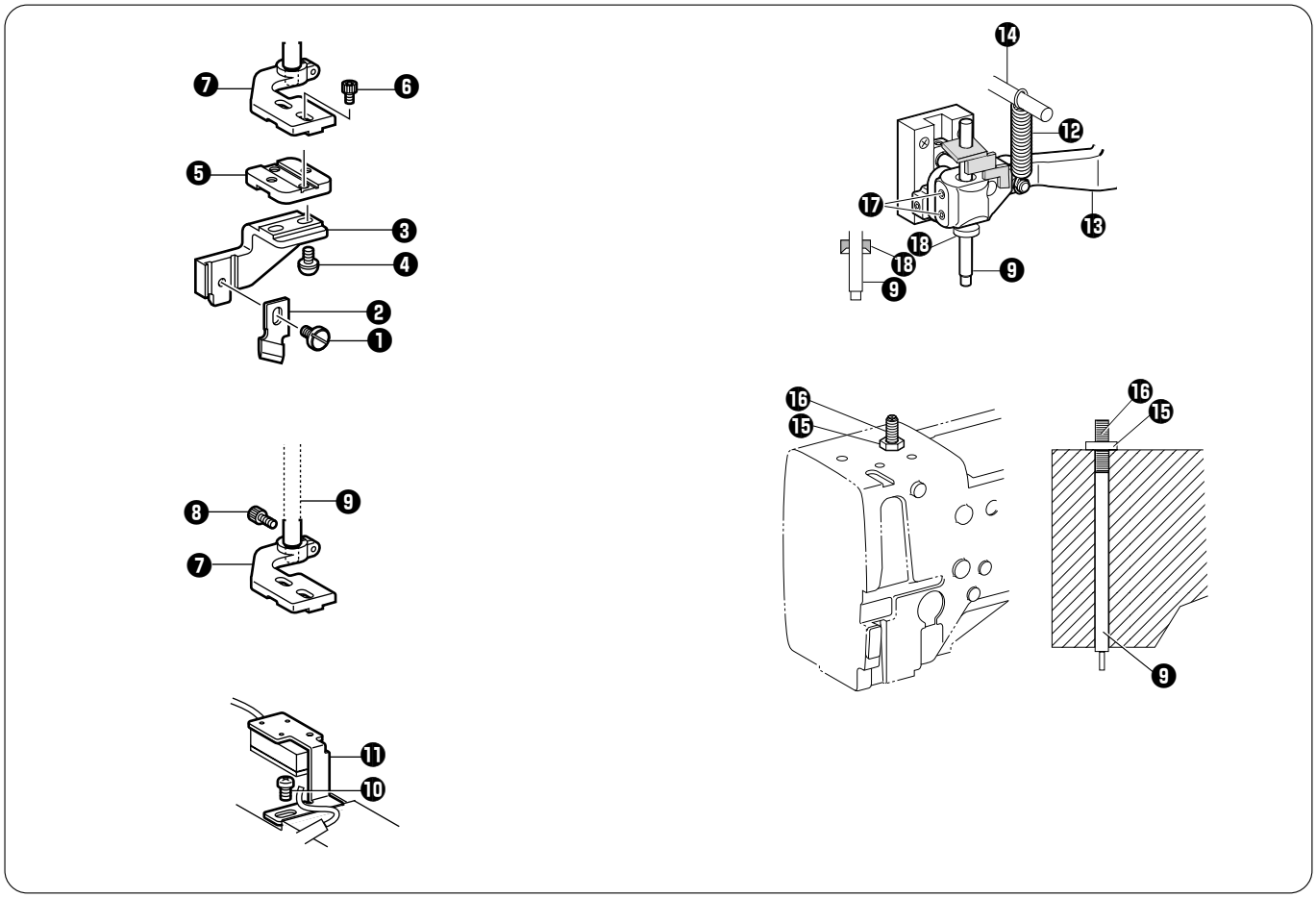
Remove the spacer ㉒, plain washer D ㉓ and bolt ㉔, and then remove the knee lifter lever ㉕ from the presser lifter connecting rod assembly ㉖.

2-7. Needle zigzag mechanism

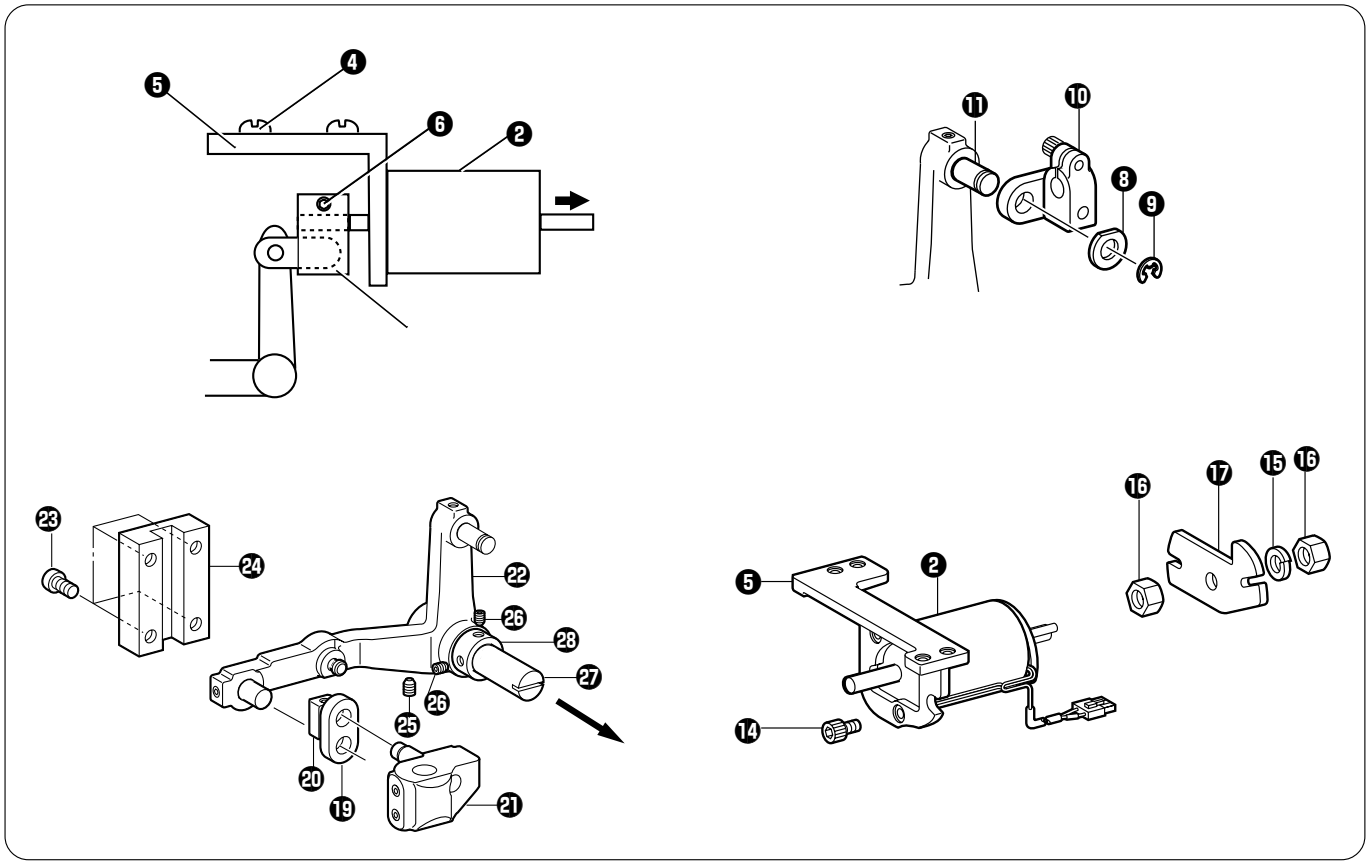


Remove the screw ❶, and then remove the zigzag sensor plate ❷ from the motor bracket ❸.
Loosen the set screw ❹, and then remove the motor lever shaft ❺, zigzag connecting rod ❻ and washer ❼ from the motor lever ❽.
Remove the screw ❿, and then remove the sensor ⓫ from the zigzag sensor plate ❷.
Remove the bolt ⓬.
Remove the thrust washer ⓭ and the zigzag lever ⓮, and then remove the zigzag lever F assembly ⓯.
Loosen the set screw ㉒, remove the zigzag connecting rod shaft ⓴ and then remove the zigzag lever ⓮ and the zigzag connecting rod ❻.

2-8. Cutter mechanism



Remove the screw ❶, and then remove the cutter ❷ from cutter holder DL ❸.
Remove the screw ❹, and then remove cutter holder DL ❸ from cutter holder M ❺.
Remove the bolt ❻, and then remove cutter holder M ❺ from the cutter holder ❼.
Remove the bolt ❽, and then remove the cutter holder ❼ from the cutter driving shaft ❾.
Remove the screw ❿, and then remove the knife sensor assembly ⓫.
Remove the spring ⓬ from the cutter driving arm assembly ⓭ and the tension release shaft ⓮.
Remove the nut ⓯, and then remove the adjusting screw assembly ⓰ from the arm.
Loosen the two set screws ⓱, and then remove the cutter driver shaft ❾.
Remove the oil rejector ⓲.



Loosen the bolt ❻.

Take out the solenoid plunger from the cutter solenoid ❷.

Remove the four screws ❹, and then remove the cutter solenoid bracket ❺.

Loosen the set screw ❷❺.

Loosen the two set screws ❷❻, and then remove the cutter driving arm shaft ❷❼, from the set screw collar ❷❽ and the cutter driving arm assembly ❷❷.

Remove the four screws ❷❸, and then remove the cutter bar guide ❷❹.

Remove the cutter driving arm assembly ❷❷ from the arm.

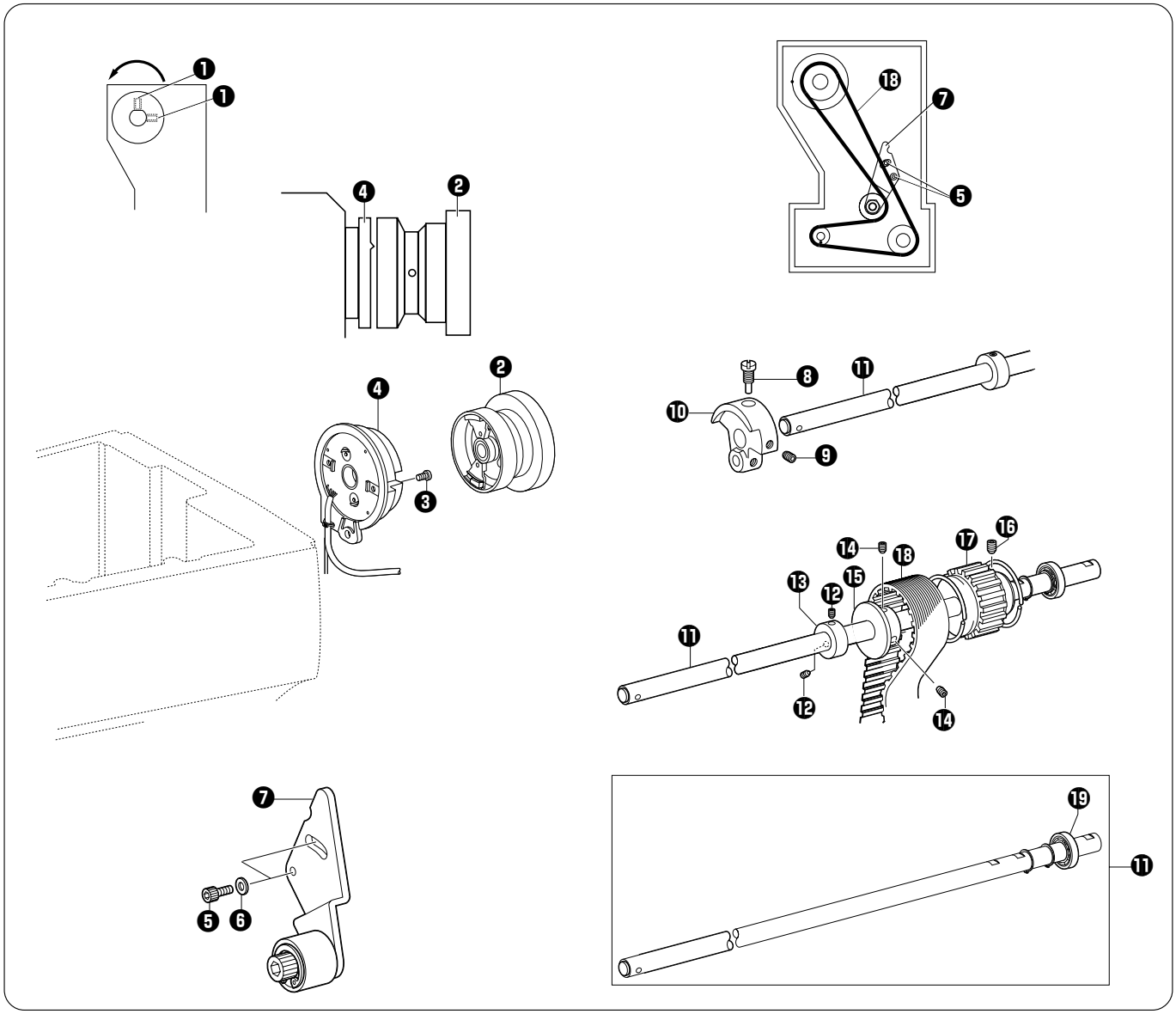
Remove the cutter driving link ❶❾, needle bar bracket slide block ❷❿ and driving shaft holder assembly ❷❶ from the cutter driving arm assembly ❷❷.

Remove the washer ❽ and retaining ring E6 ❾, and then remove the cutter link bracket assembly ❶❿ from the cutter link shaft ❶❶.

Remove the three bolts ❶❹, and then remove the cutter solenoid ❷ from the cutter solenoid bracket ❺.

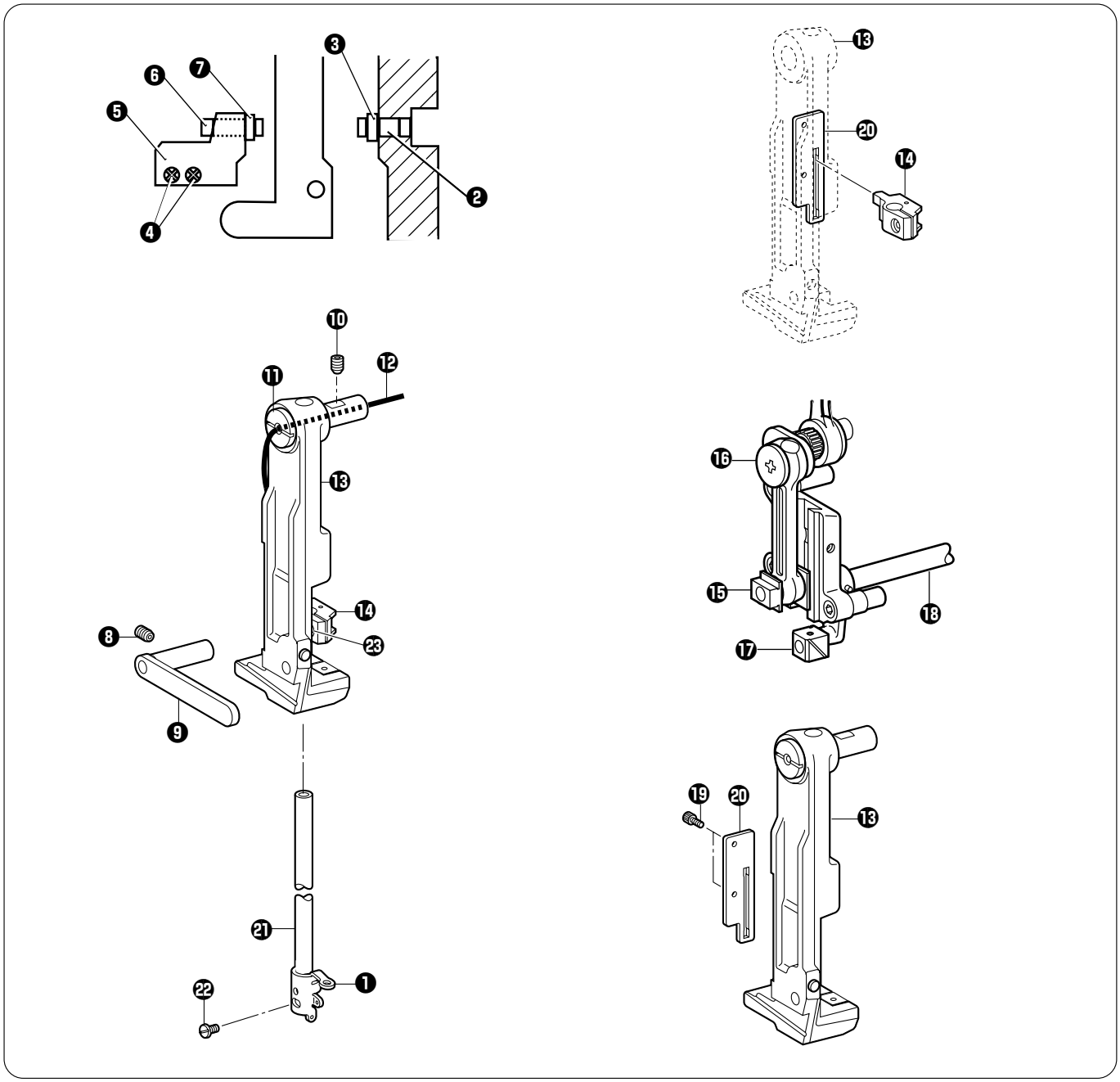
Remove the spring washer ❶❺ and the two nuts ❶❻, and then remove the solenoid stopper ❶❼ from the solenoid flange.

2-9. Upper shaft and tension pulley mechanism

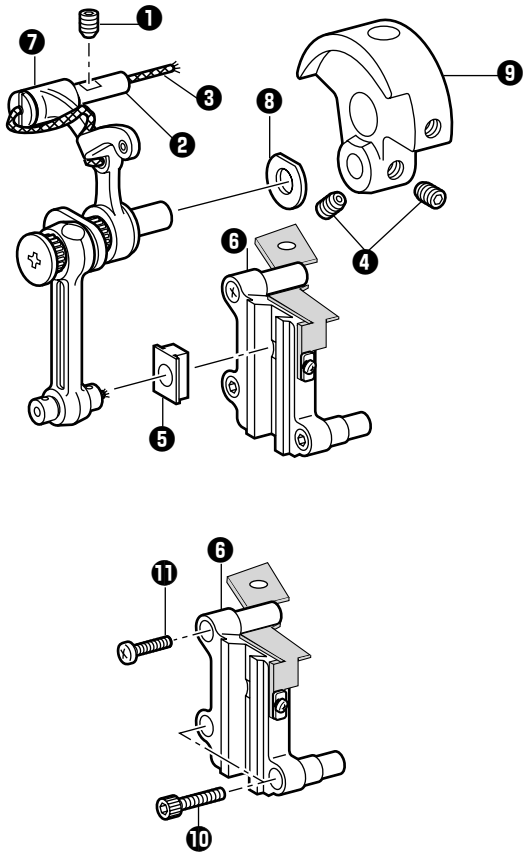


Loosen the screw ❶, and then remove the pulley assembly ❷.
Remove the screw ❸, and then remove the synchronizer assembly H80 ❹ from the arm.
Remove the two bolts ❺ and the two plain washers ❻, and then remove the tension pulley assembly ❼.
Remove the screw ❽ and the set screw ❾, and then remove the thread take-up crank ❿ from the upper shaft assembly ⓫.
Loosen the two set screws ⓬, and then remove the set screw collar assembly ⓭.
Loosen the two set screws ⓮, and then remove the bobbin winder pulley ⓯.
Loosen the set screw ⓰, and then remove the timing pulley U assembly ⓱.
Remove the timing belt ⓲.
Remove the bearing ⓳.

2-10. Needle bar and thread take-up mechanism

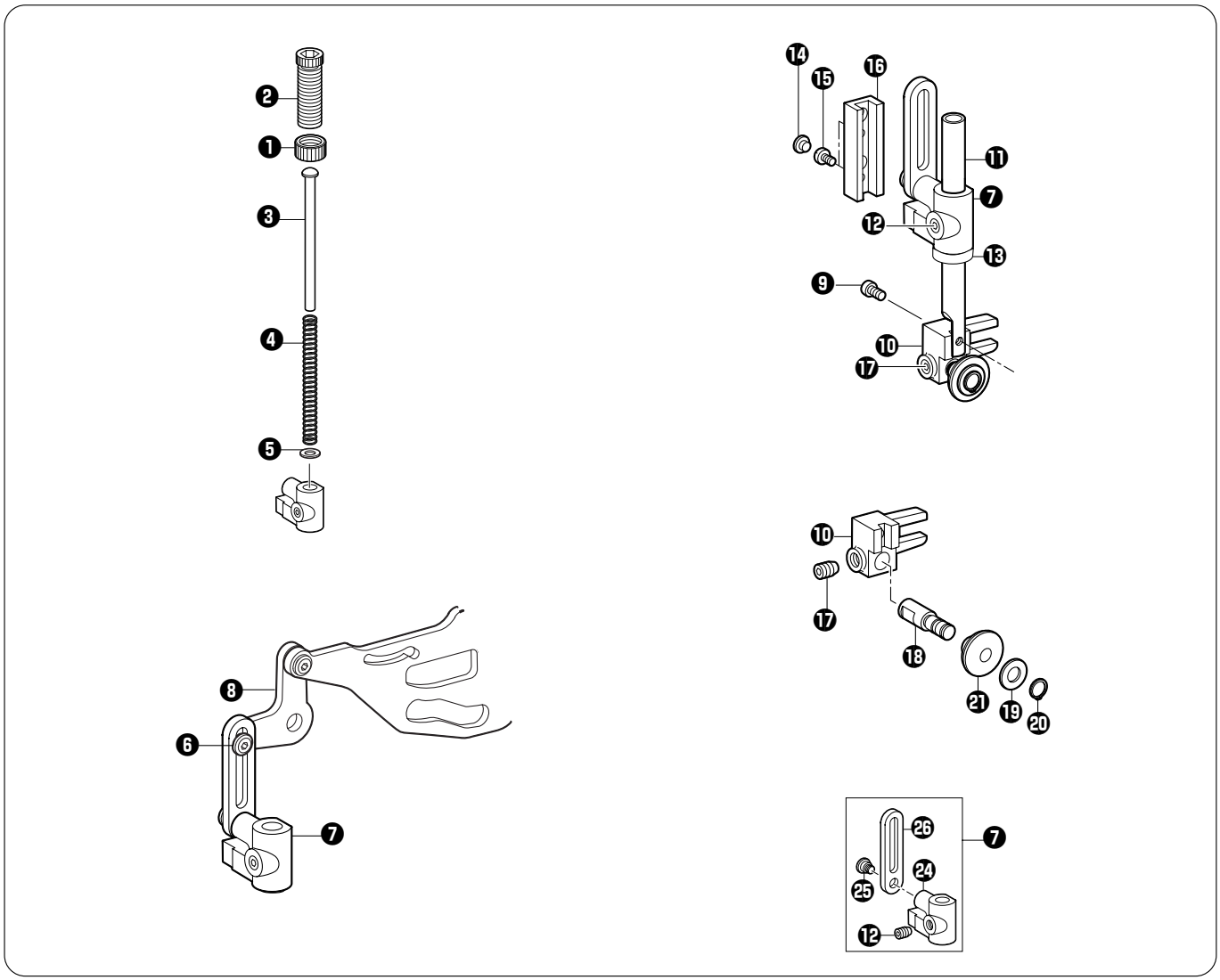


Remove the set screw ❷ and nut ❸ from the arm.
Remove the screw ❹, and then remove the stopper ❺ from the arm.
Remove the set screw ❻ and the nut ❼ from the stopper ❺.
Remove the set screw ㉒, and then remove the needle bar thread guide ❶ from the needle bar ㉑.
Loosen the set screw ❽, and then remove the needle bar thread guide ❾.
Loosen the set screw ❿, and then remove the needle bar bracket support shaft ⓫.
Remove the wick ⓬.
Remove the needle bar bracket assembly ⓭ from the arm.
Remove the slide block ⓯ of the needle bar clamp ⓮ from the thread take-up lever set ⓰.
Remove the slide block ⓱ of the needle bar bracket assembly ⓭ from the zigzag lever shaft ⓲.
Remove the bolt ⓳, and then remove the needle bar guide ⓴ from the needle bar bracket assembly ⓭.
Loosen the screw ㉓ of the needle bar clamp ⓮, and then remove the needle bar ㉑.



Remove the set screw ❶, and then remove the support shaft ❷.
Remove the wick ❸.
Loosen the two set screws ❹.
Remove the thread take-up lever set ❼ and the washer ❽ from the thread take-up crank ❾.
Remove the needle bar bracket slide block ❺.
Remove the two bolts ❿ and the screw ⓫, and then remove the crank rod guide ❻.

2-11. Presser bar mechanism



Loosen the presser adjusting nut ❶.

Remove the presser adjusting screw ❷, and then remove the spring guide ❸, compression spring ❹ and plain washer ❺.

Remove the shoulder screw ❻, and then remove the presser bar guide bracket assembly ❼ from the knee lifter lever ❽.

Remove the screw ❾, and then remove the presser roller bracket ❿ from the presser bar ⓫.

Loosen the set screw ⓬.

Remove the presser bar ⓫, and then remove the oil rejector ⓭ and the presser bar guide bracket assembly ❼.

Remove the rubber cap ⓮.

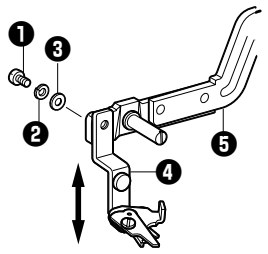
Remove the screw ⓯, and then remove the needle bar guide ⓰.

Loosen the set screw ⓱, and then remove the roller shaft ⓲ from the presser roller bracket ❿.

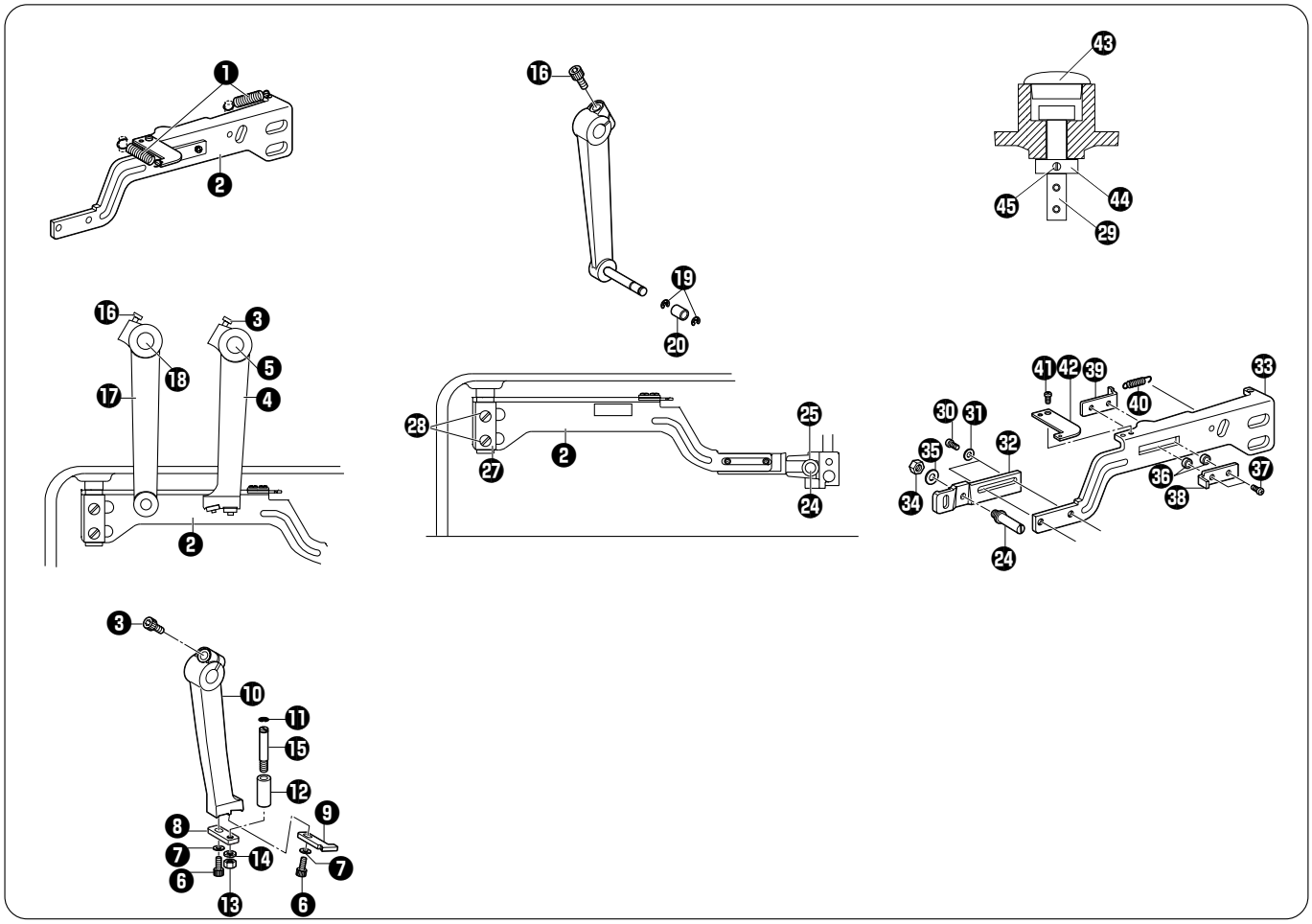
Remove the plain washer ⓳ and the retaining ring ⓴, and then remove the roller ㉑ from the roller shaft ⓲.

Remove the shoulder screw ㉕, and then remove the presser bar lifter link ㉖ from the presser bar guide bracket ㉔.

2-12. Upper thread trimmer mechanism

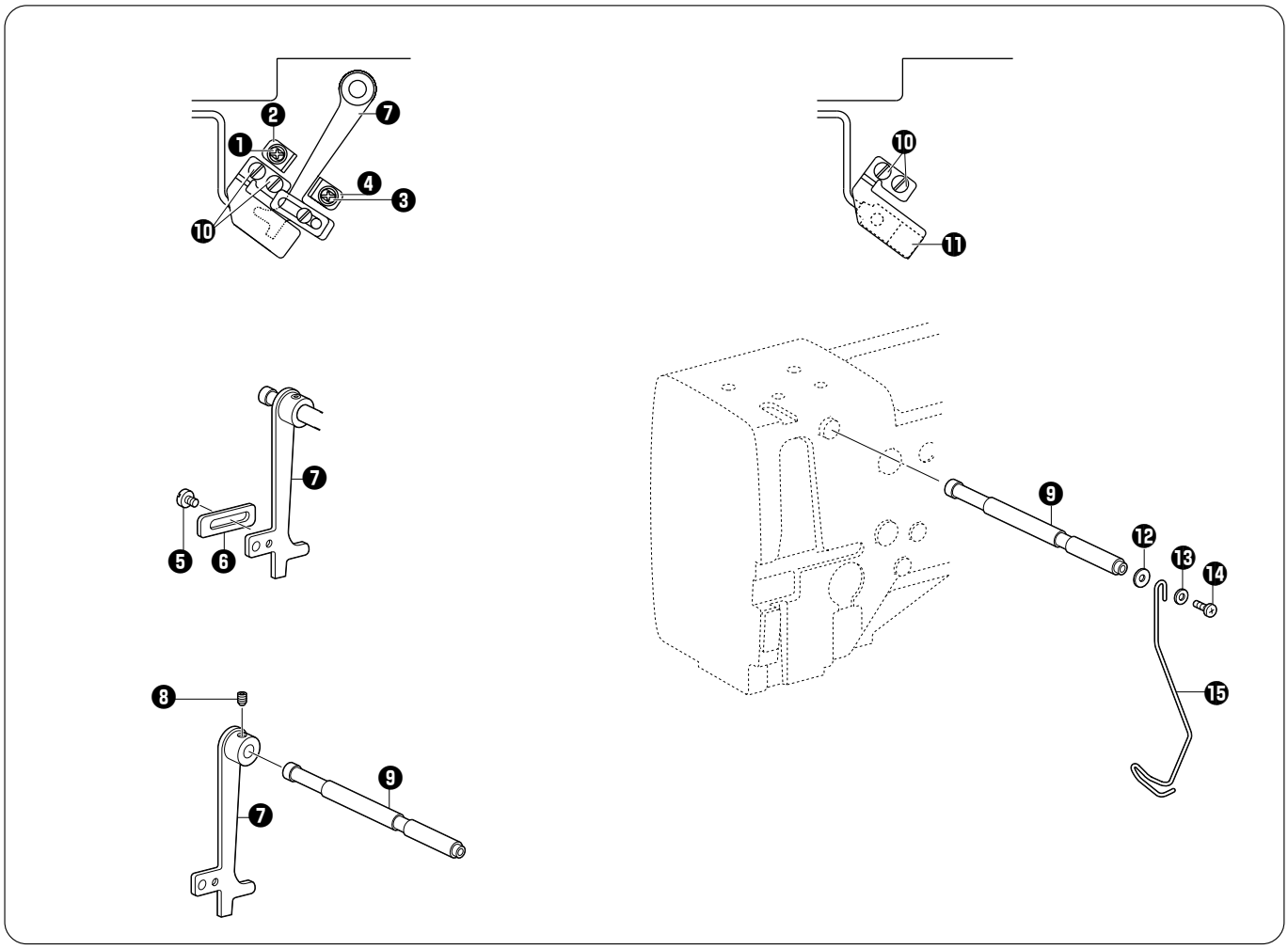


Remove the screw ❶, spring washer ❷ and plain washer ❸, and then remove the upper thread trimmer assembly ❹ from the upper thread trimmer lever ❺.



Remove the two springs ❶ from the upper thread trimmer lever set ❷.
Remove the eye bolt ❸, and then remove the trimmer driving arm assembly ❹ from the trimmer driving lever ❺.
Remove the eye bolt ❻ and the plain washer ❼, and then remove the support plate ❽ and the stopper ❾ from the trimmer driving arm ❿.
Remove the retaining ring ⓫, and then remove the driving arm roller ⓬.
Remove the nut ⓭ and the spring washer ⓮, and then remove the roller shaft ⓯ from the support plate ❽.
Remove the eye bolt ⓰, and then remove the longitudinal feed arm assembly ⓱ from the trimmer driving lever ⓲.
Remove the two retaining rings ⓳, and then remove the longitudinal feed arm roller ⓴.
Remove the washer ㉗ and the two shoulder screws ㉘, and then remove the upper thread trimmer lever set ❷ from the upper thread trimmer fulcrum shaft ㉙.
Remove the roller ㉕.
Remove the screw ㉚ and the plain washer ㉛, and then remove the setting plate ㉜ from the upper thread trimmer lever assembly ㉝.
Remove the nut ㉞ and the plain washer ㉟, and then remove the support shaft ㉔ from the setting plate ㉜.
Remove the two collars ㊱ and the two screws ㊲, and then remove the back plate ㊳ and the stop plate ㊴ from the upper thread trimmer lever assembly ㉝.
Remove the spring ㊵.
Remove the screw ㊶, and then remove the spring hook plate ㊷ from the upper thread trimmer lever assembly ㉝.
Remove the rubber cap ㊸.
Loosen the set screw ㊺ of the set screw collar assembly ㊹, and then remove the upper thread trimmer fulcrum shaft ㉙.

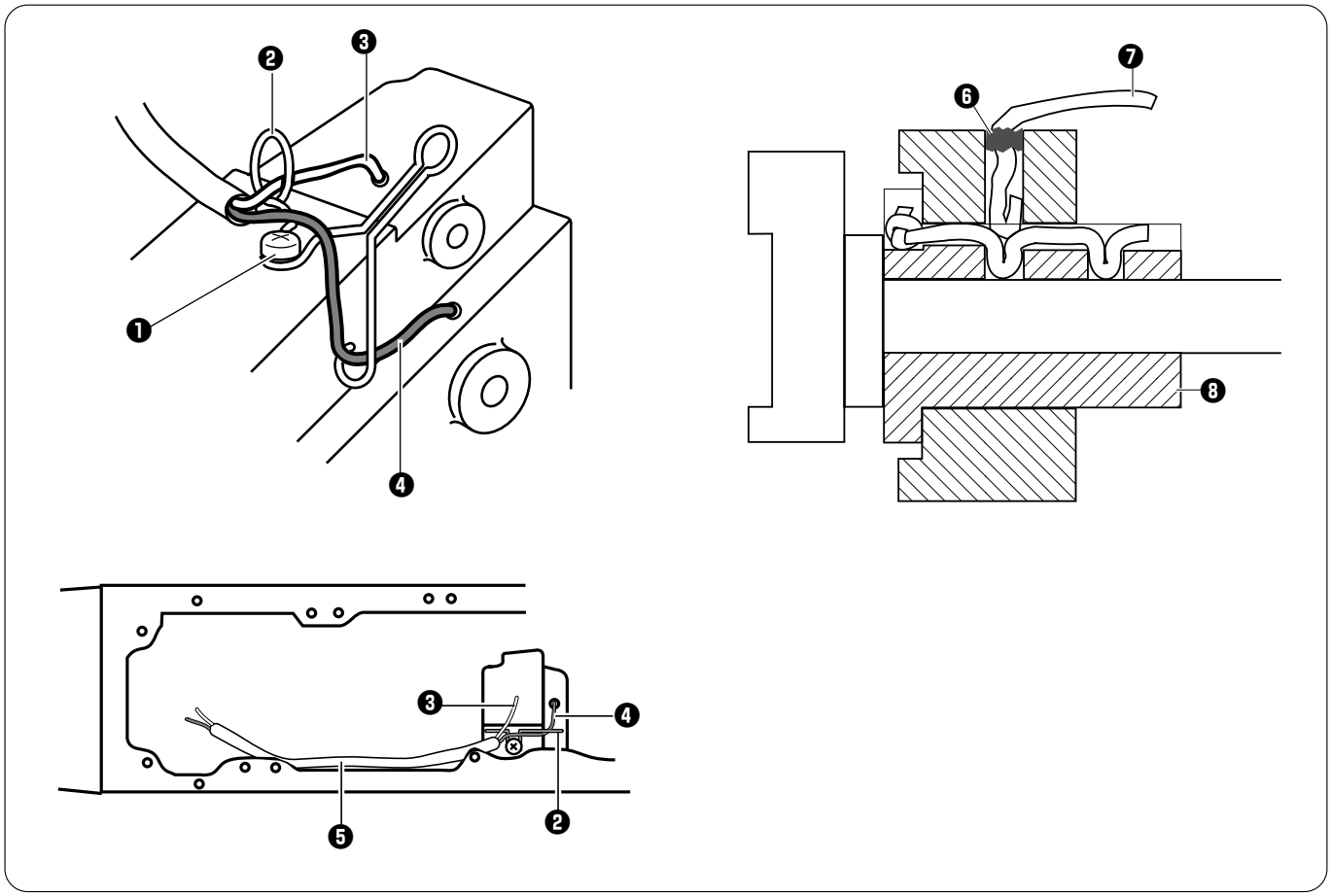
2-13. Thread breakage detection mechanism



Remove the screw ❶, and then remove the lever stopper ❷.
Remove the screw ❸, and then remove the lever stopper ❹.
Remove the screw ❺, and then remove the balancer ❻ from the cutter bar fixing plate ❼.
Loosen the set screw ❽, and then remove the cutter bar fixing plate ❼ from the thread breakage perceiving shaft ❾.
Remove the two screws ❿, and then remove the thread breakage sensor assembly.
Take the thread breakage perceiving shaft ❾ out from the arm.
Remove the plain washer ⓬, plain washer ⓭ and screw ⓮, and then remove the thread guide ⓯ from the thread breakage perceiving shaft ❾.

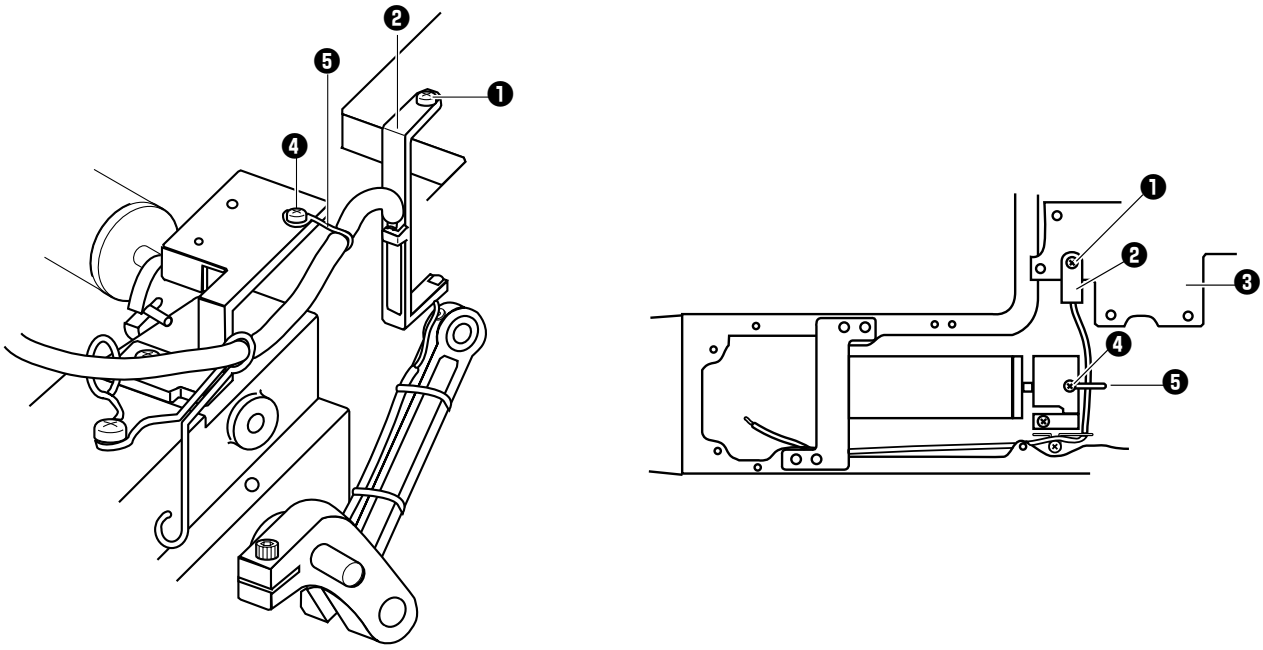
2-14. Lubrication mechanism

Shaft bush mechanism



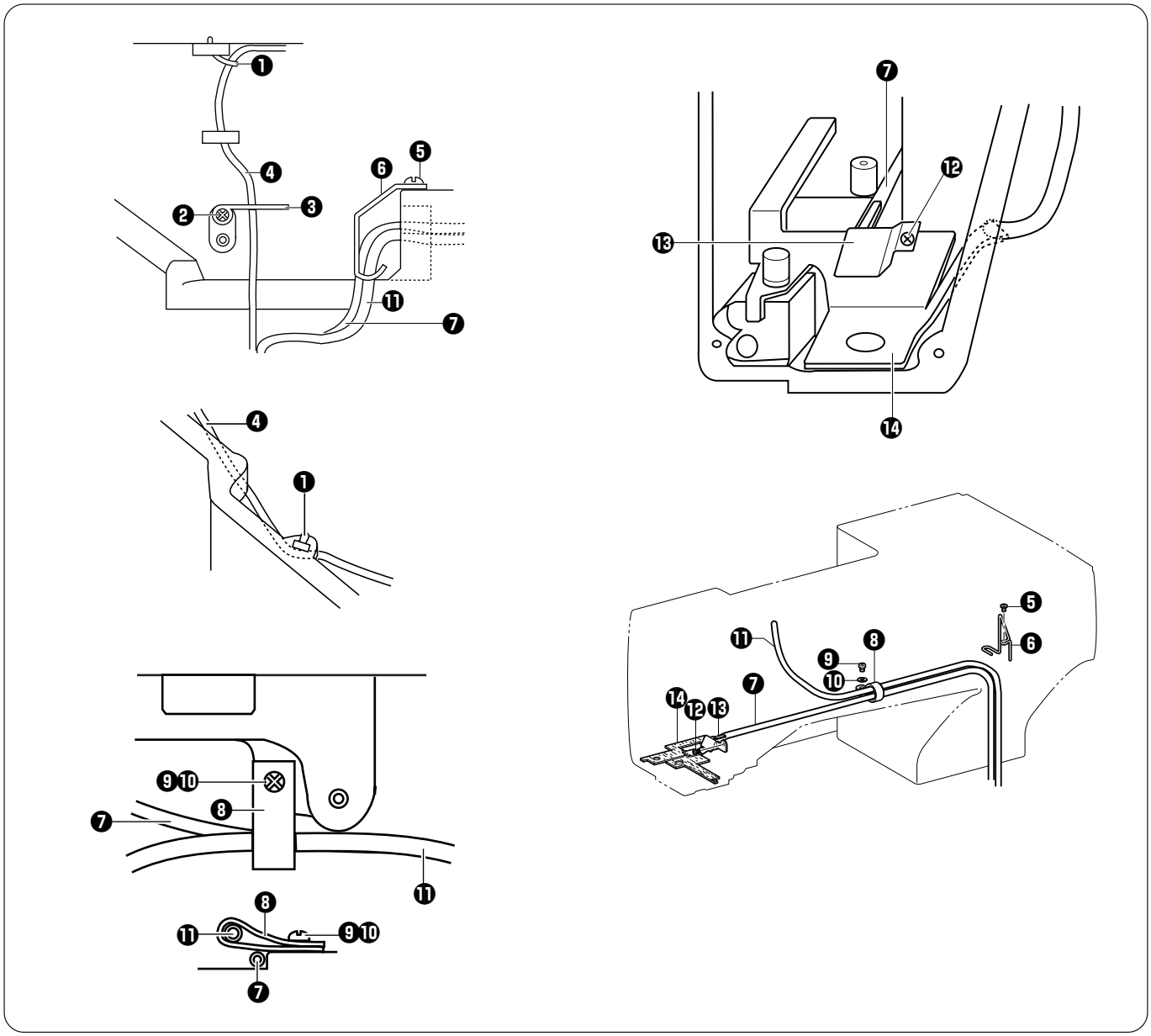
Remove the screw ❶, and then remove tube support U ❷.
Remove the wicks ❸ and ❹, and then disconnect the oil tube ❺.
Remove the felt ❻, and then remove the wick ❼ from bush F ❽.

Needle zigzag mechanism



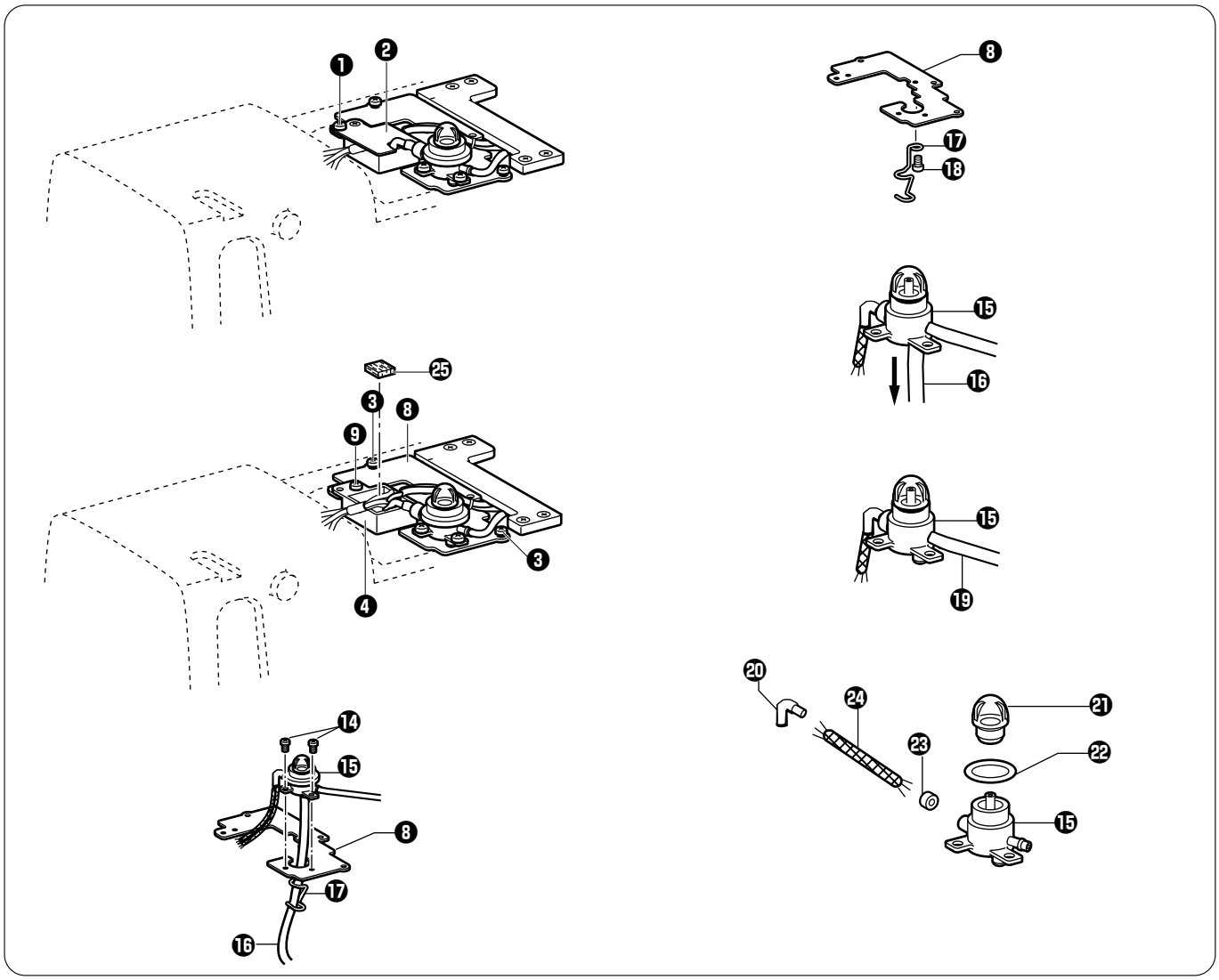
Remove the screw ❶, and then remove the felt support ❷ from the motor bracket ❸.
Remove the screw ❹, and then remove the tube support ❺.

Oil tubes



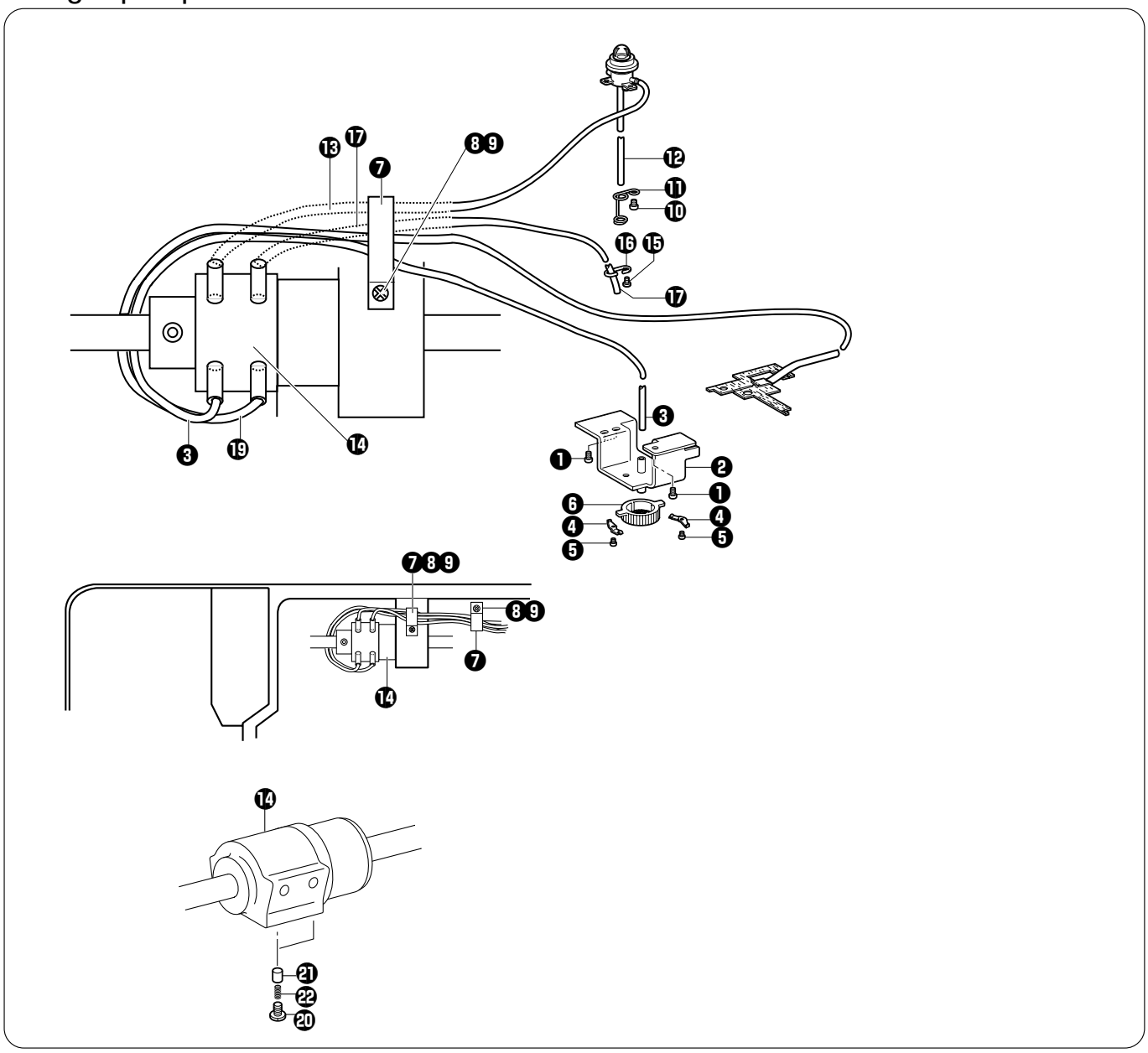
Remove the fastening band ❶.
Remove the screw ❷, and then remove tube support M ❸.
Disconnect the oil tube ❹ that is connected to the oil terminal and the plunger pump.
Remove the screw ❺, and then remove the tube support ❻.
Remove the cord holder ❽, screw ❾ and washer ❿, and then disconnect the oil tubes ⓫ and ❼ that are connected between the oil terminal and the oil outlet.
Remove the screw ⓬, and then remove the felt holder ⓭.
Remove the felt ⓮, and then disconnect the oil tube ❼.

Oil terminal mechanism



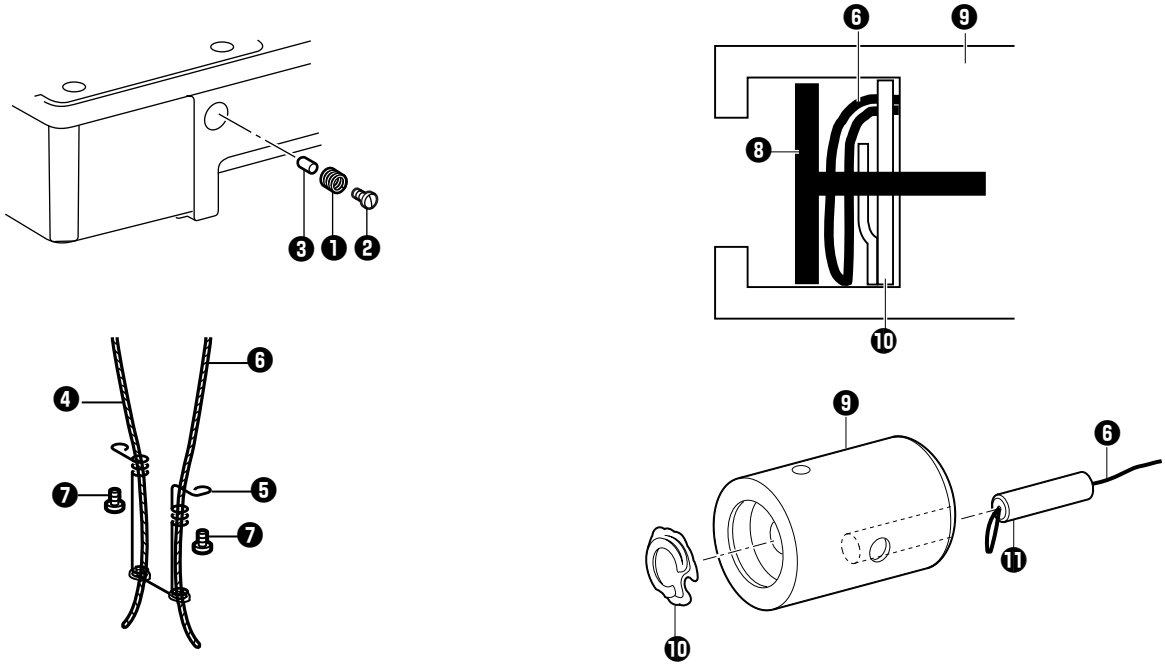
Remove the screw ❶, and then remove the cap ❷ and the felt ㉕.
Remove the screw ❾, and then remove felt base A ❹ from the wick base support ❽.
Remove the screw ❸, and then remove the wick base support ❽.
Remove the two screws ⓮, and then remove the oil terminal ⓯ from the wick base support ❽.
Remove the oil tube ⓰ that is connected between the oil terminal and the oil outlet from the tube support ⓱.
Remove the screw ⓲, and then remove the tube support ⓱ from the wick base support ❽.
Remove the oil tube ⓰ that is connected between the oil terminal and the oil outlet from the wick base support ❽.
Disconnect the oil tube ⓳ that is connected between the oil terminal and the oil outlet from the oil terminal ⓯.
Disconnect oil pipe B ⓴ from the oil terminal ⓯.
Remove the oil cap ㉑, and then remove the packing ㉒ from the oil terminal ⓯.
Remove the collar ㉓ and the wick ㉔ from the oil terminal ⓯.

Plunger pump mechanism



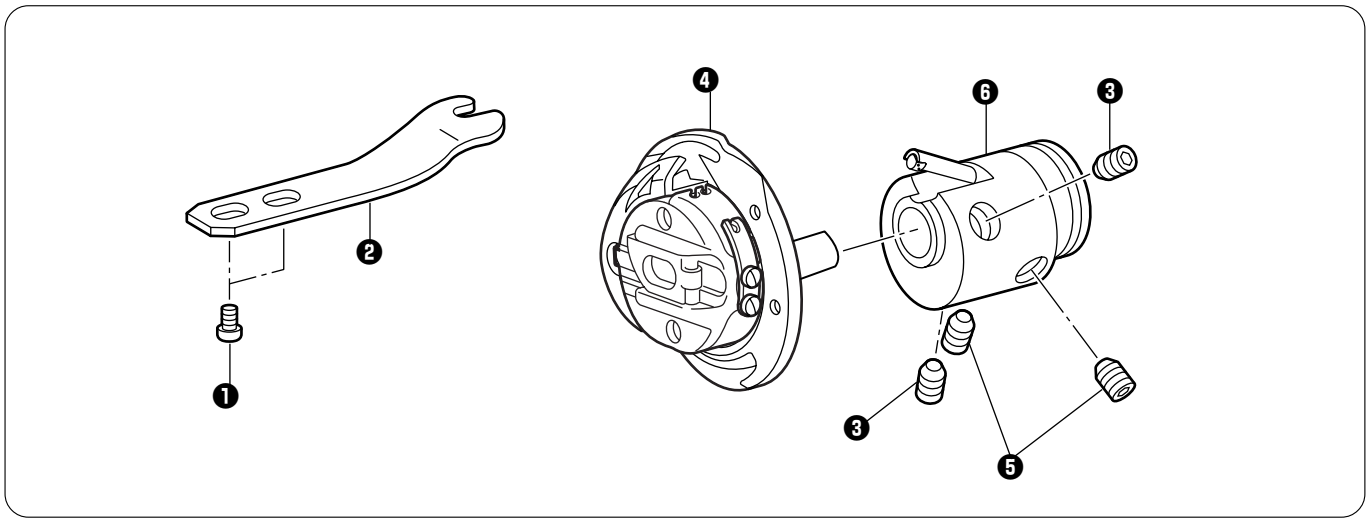
Remove the three screws ❶, and then remove the oil filter bracket ❷ from the bed.
Remove the oil tube ❸ that is connected between the plunger and the filter from the oil filter bracket ❷.
Remove the two springs ❹ and the two screws ❺, and then remove the pump filter ❻ from the oil filter bracket ❷.
Remove the cord holder ❼, screw ❽ and plain washer ❾.
Remove the screw ❿, and then remove tube support D ⓫ from the oil tube ⓬ that is connected between the oil terminal and the oil outlet and from the bed.
Remove the oil tube ⓭ that is connected between the oil teminal and the plunger pump from the lubricating holeto the left of bush M ⓮.
Remove the screw ⓯, and then remove the tube support ⓰ from the oil tube ⓱ and from the bed.
Remove the outlet oil tube ⓱ from the lubricating hole to the right of bush M ⓮.
Remove the oil tube ❸ that is connected between the plunger and the filter from the inlet hole to the left of bush M ⓮.
Remove the oil tube ⓳ from the inlet hole to the right of bush M ⓮.
Remove the two screws ⑳, and then remove the two plungers ㉑ and the two compression springs ㉒ from bush M ⓮.

Rotary hook lubricating mechanism



Remove the spring ❶ and the screw ❷, and then remove the rubber presser ❸ from the bed.
Remove the wick ❹ from the felt support ❺.
Remove the wick ❻ from the felt support ❺.
Remove the two screws ❼, and then remove the felt support ❺ from the bed.
Remove the end of the felt ❽ from the bush ❾.
Remove the spring ❿ from the bush ❾.
Remove the collar ⓫ from the bush ❾.
Remove the wick ❻ from the collar ⓫.

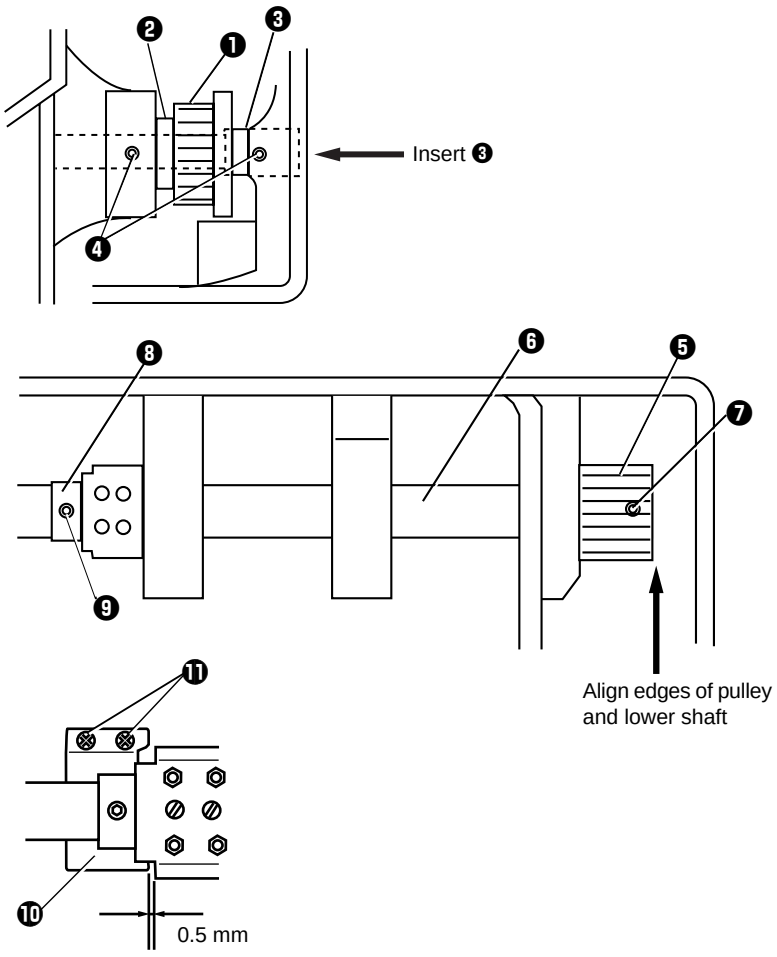
2-15. Rotary hook mechanism



Remove the two screws ❶, and then remove the rotary hook holder ❷.
Loosen the set screw ❸, and then remove the rotary hook ❹.
Loosen the set screw ❺, and then remove the rotary hook joint assembly ❻.

3. ASSEMBLY

3-1. Lower shaft and idle pulley mechanism

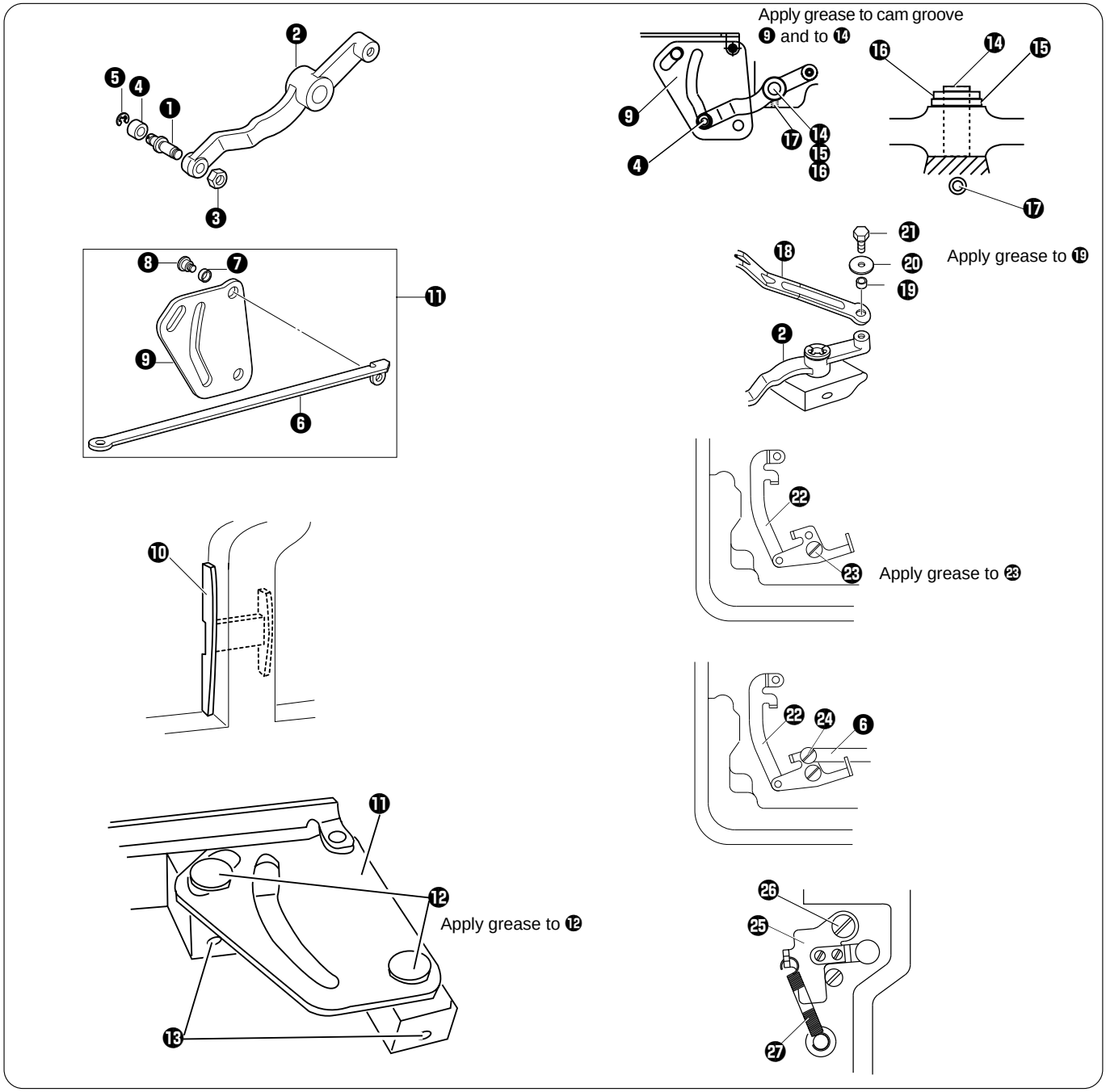


After attaching the timing belt to the idle pulley assembly ❶, insert the collar ❷. Insert the shaft ❸, and then install the assembly to the bed with the two set screws ❹.

Install the timing pulley assembly ❺ to the lower shaft ❻ with the set screw ❼, and then place the set screw collar assembly ❽ onto the lower shaft ❻ and then install the lower shaft ❻ to the bed. After checking the thrust direction, securely tighten the set screw ❾. The screw stop position is the start of the rotation direction.

Install the cover ❿ with the two screws ⓫.

3-2. Lower thread trimmer mechanism



Insert the roller shaft ❶ into the lower thread trimmer cam lever ❷, and secure it by tightening the nut ❸. Place the roller ❹ onto the roller shaft ❶, and then install the retaining ring ❺.

Install the lower thread trimmer cam connecting rod ❻ to the lower thread trimmer cam ❾ with the driving lever roller ❼ and the shoulder screw ❽. (Lower thread trimmer cam assembly ⓫)

Install the cover ⓾ to the bed.

Pass the lower thread trimmer cam assembly ⓫ through the cover ⓾ and install it to the bed with the two lever shafts ⓬. Tighten the two set screws ⓭ so that the lower thread trimmer cam assembly ⓫ moves smoothly without any play.

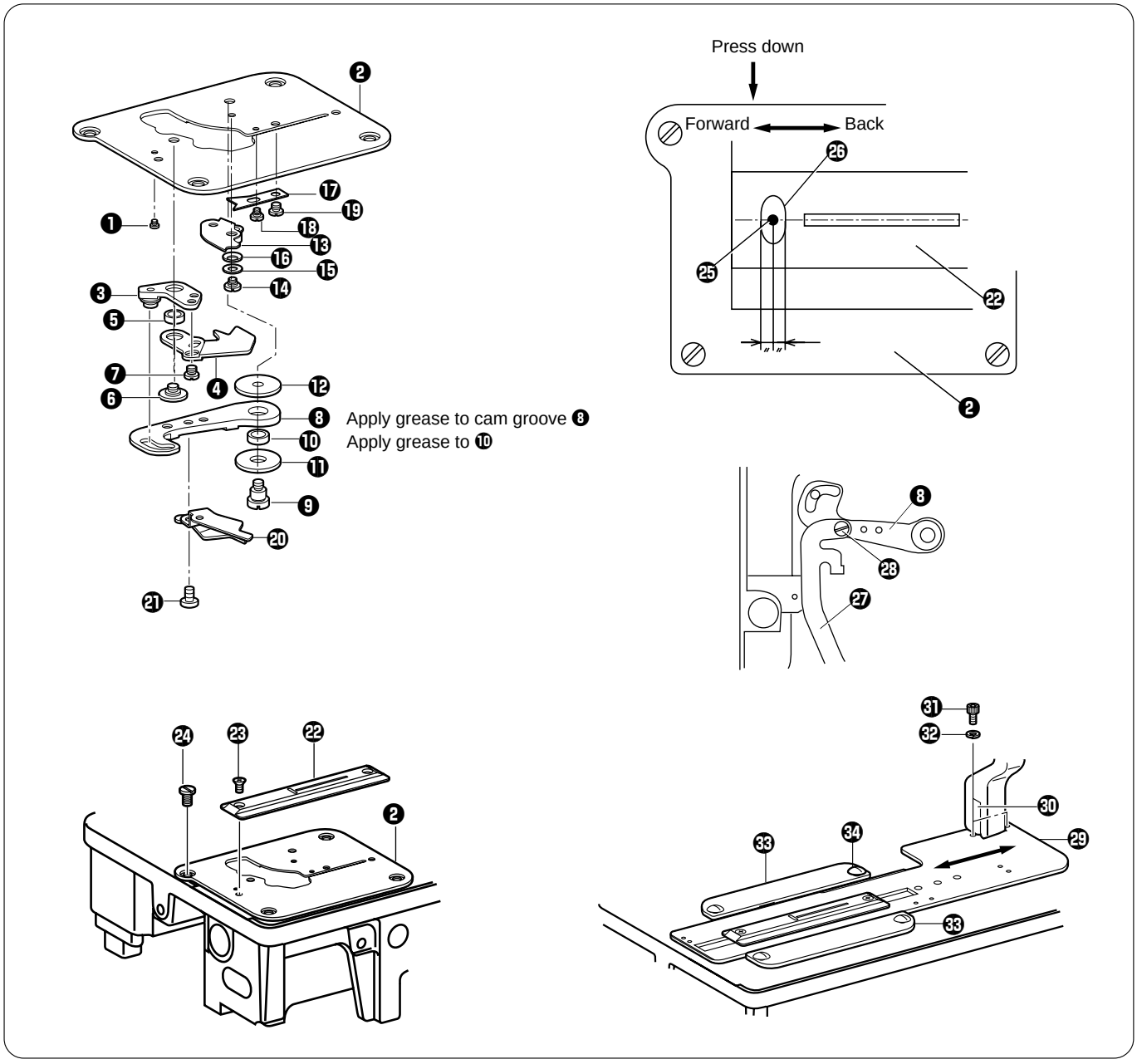
Insert the roller ❹ into the lower thread trimmer cam ❾, and then install it to the bed with the lower thread trimming cam shaft ⓮, washer ⓯ and retaining ring ⓰. Secure by tightening the set screw ⓱.

Connect the presser lifter connecting rod set ⓲ and the lower thread trimmer cam lever ❷ using plain washer D ⓴, and the bolt ㉑.

Install the lower thread trimmer link assembly ㉒ with the shoulder screw ㉓.

Connect the lower thread trimmer link assembly ㉒ and the lower thread trimmer cam connecting rod ❻ with the shoulder screw ㉔.

Install the opening plate assembly ㉕ with the shoulder screw ㉖. Install the plate spring ㉗ as shown in the illustration.



Install the screw ❶ to the base plate ❷. Install the lever assembly ❸ and the lower thread retainer ❹ to the base plate ❷ with the collar ❺ and the screw ❻. Install the lower thread retainer ❹ to the lever assembly ❸ with the two screws ❼.

Insert the roller of the lever assembly ❸ into the cam groove of the knife driving lever ❽.

Install the knife driving lever ❽ to the base plate ❷ with the shoulder screw ❾, collar ❿, washer U ⓫ and washer D ⓬.

Install the lower thread clamp plate assembly ⓭ to the base plate ❷ with the shoulder screw ⓮, plain washer ⓯ and curved washer ⓰. Install the lower thread presser ⓱ to the base plate ❷ with the shoulder screw ⓲ and the screw ⓳.

Install the fixed knife set ⓴ to the knife driving lever ❽ with the two screws ㉑.

Install the needle plate ㉒ with the pan screw ㉓ so that it is parallel to the base plate ❷.

Provisionally install the base plate ❷ to the top of the bed with the four screws ㉔.

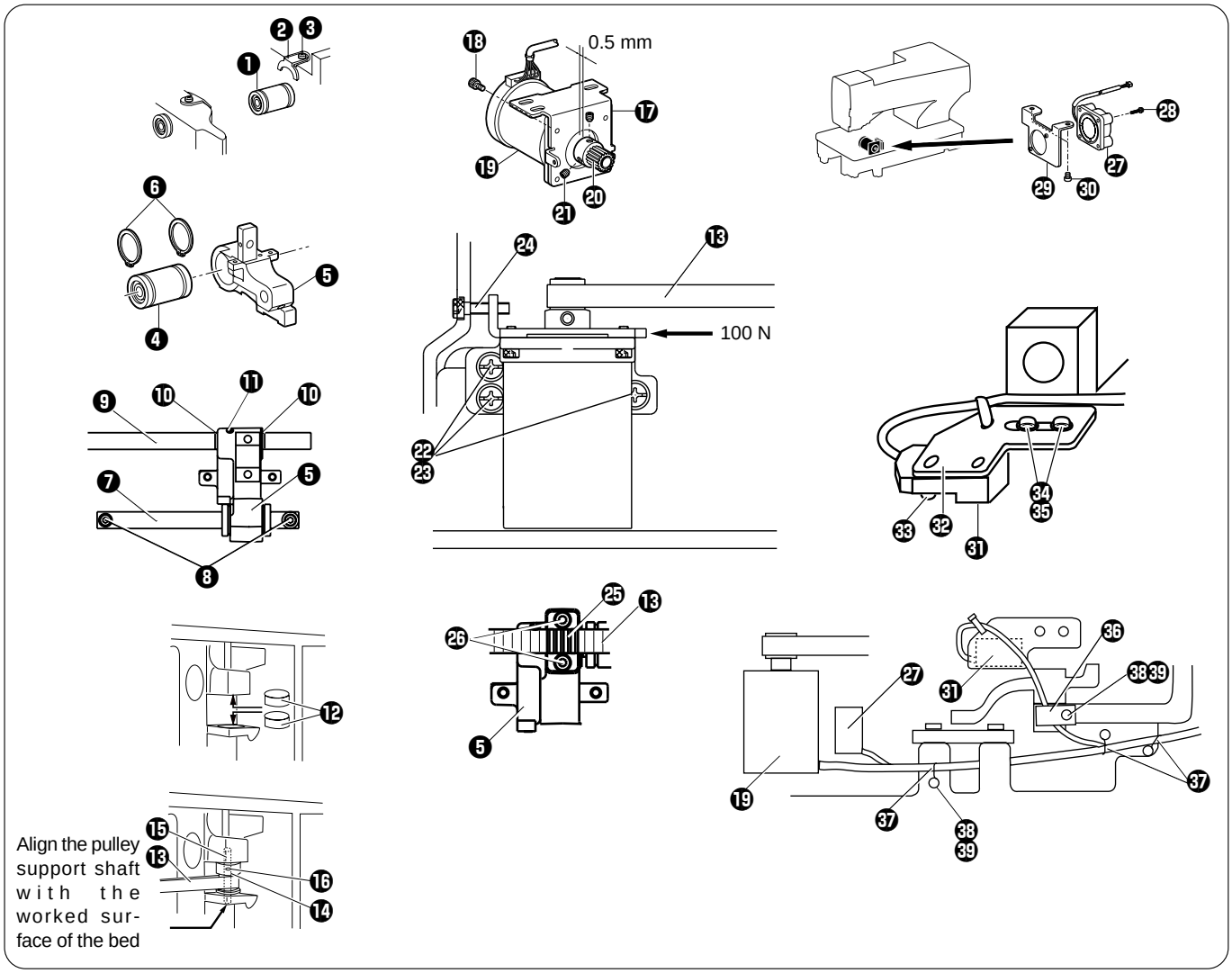
While pushing the base plate ❷ to the right so that the needle ㉕ is in the center of the needle hole ㉖ in the longitudinal direction, securely tighten the screws ㉔.

Connect the lower thread trimmer link assembly ㉗ and the knife driving lever ❽ with the shoulder screw 4.37 ㉘.

Install the length feed plate ㉙ to the feed arm support ㉚ with the bolt ㉛ and washer ㉜.

Install the feed presser plate ㉝ with the screw ㉞ so that the feed mechanism moves easily when it is moved back and forth by hand.

3-3. Feed mechanism



Install the two feed shaft linear bushes ❶ to the bed. Secure the ball bearing stopper ❷ with the screw ❸. Place the linear bush ❹ onto the feed arm support ❺ and install it with the two retaining rings ❻.

Pass the feed arm support ❺ through feed guide shaft A ❼ and install it to the bed. Provisionally tighten the two bolts ❽. Place feed guide shaft B ❾ through the feed arm support ❺, align the reference lines ❿, and then secure by tightening the set screw ⓫. Securely tighten the two bolts ❽ so that the feed arm support ❺ moves smoothly.

Install the two ball bearings (688ZZNR) ⓬ to the bed.

Place the timing belt ⓭ onto the pulley B assembly ⓮, and then insert the support shaft ⓯. Install the pulley B assembly ⓮ to the support shaft ⓯ and secure by tightening the set screw ⓰.

Install the motor mounting bracket ⓱ to the feed pulse motor ⓳ with the four bolts ⓲.

Install the pulley A assembly ⓴ so that there is a gap of 0.5 mm between it and the motor, and secure it by tightening the two set screws ㉑.

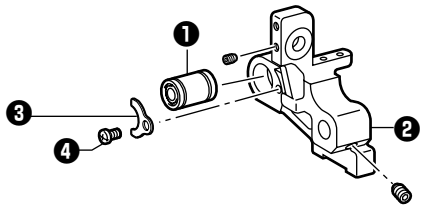
Place the timing belt ⓭ onto the feed pulse motor ⓳, and then provisionally tighten it with the three screws ㉒ and the three washers ㉓. Push the motor mounting bracket ⓱ in the direction of the arrow with a force of 100 N, and then securely tighten the screws ㉒. Gently tighten the eye bolt ㉔. If there is no tension gauge available, apply a force of 5 N at the middle of the timing belt ⓭ span and adjust so that the amount of deflection at this time is 3.5 mm.

Place the belt holder ㉕ onto the timing belt ⓭, and then install it to the feed arm support ❺ with the two bolts ㉖.

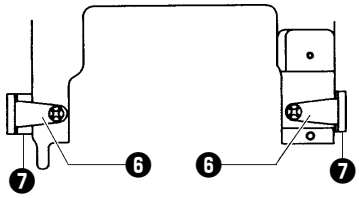
Install the DC fan motor 40 assembly ㉗ to the feed motor cover ㉙ with the two screws ㉘. Install the feed motor cover ㉙ to the bed with the screw ㉚.

Install the feed home position sensor ㉛ to the feed sensor support plate ㉜ with the screw ㉝. Install the feed sensor support plate ㉜ to the bed with the screw ㉞ and the plain washer ㉟.

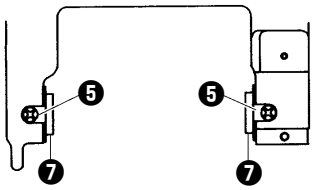
Pass the cords for the feed pulse motor ⓳, DC fan motor 40 assembly ㉗ and feed home position sensor ㉛ through the cord holder ㊱ and the cord supports ㊲ as shown in the illustration, and secure to the bed with the screw ㊳ and the plain washer ㊴.

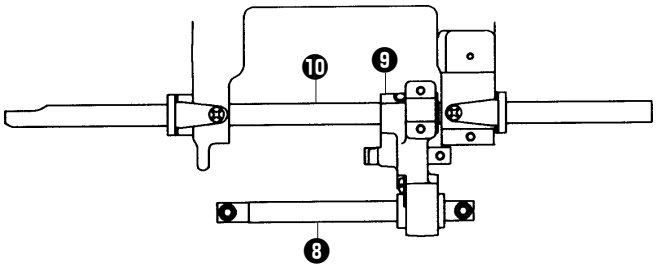


[For long-hole]



[-2 specifications]





For long-hole (-5) specifications

Insert the linear bush 9.53 (for long-hole) ❶ into the feed arm support -5 (for long-hole) ❷.

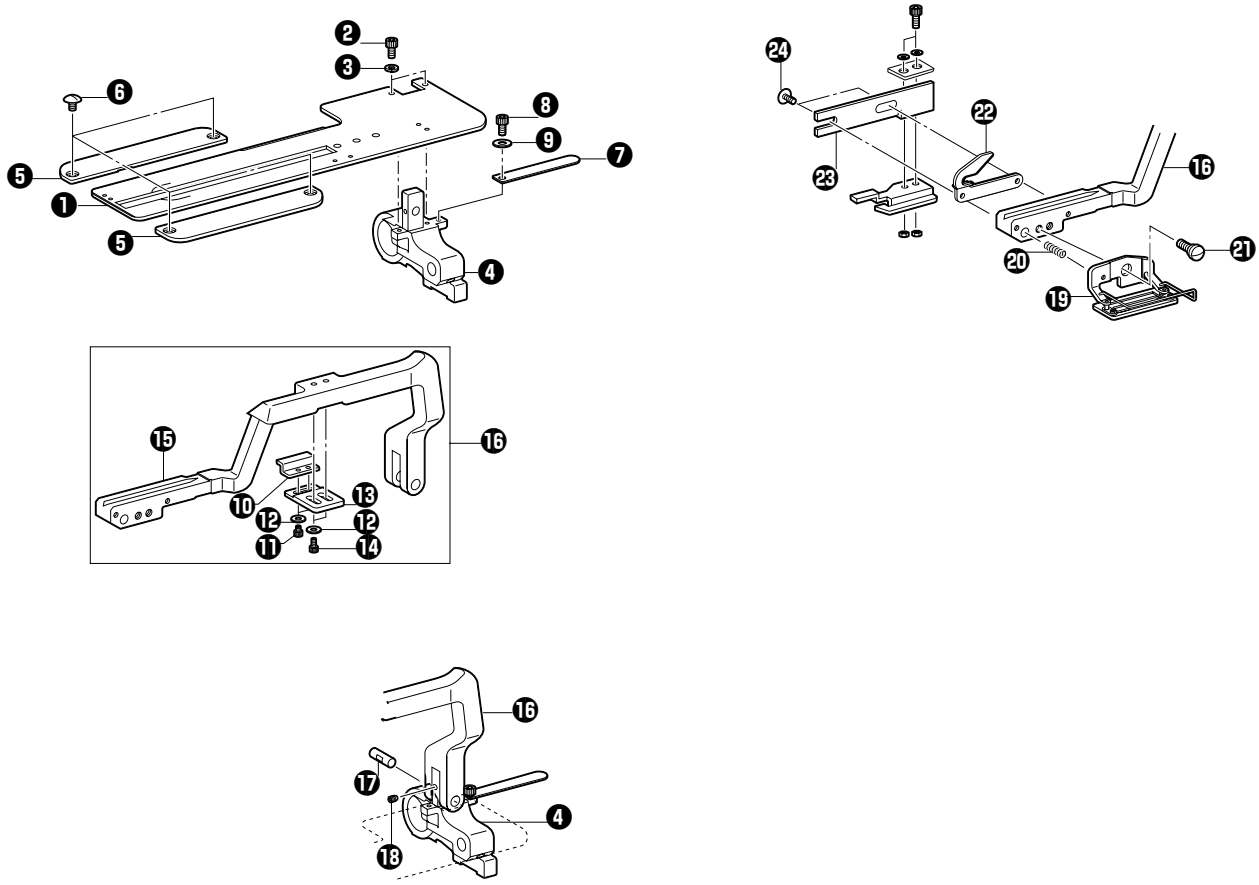
Secure the linear bush 9.53 (for long-hole) ❶ by tightening the linear bush stopper plate (for long-hole) ❸ and the screw 4.37-40x6 ❹.

Replace the two ball bearing stoppers ❺ with the two ball bearing stoppers (for long-hole) ❻, and change the two linear bushes ❼ to the positions for long-hole specifications.

With feed guide shaft A-5 (for long-hole) ❽ inserted into the feed arm support -5 (for long-hole) ❾, insert into the bed.

Insert feed guide shaft B-5 (for long-hole) ❿ into the feed arm support -5 (for long-hole) ❾. Install so that the reference line on feed guide shaft B-5 (for long-hole) ❿ is aligned with the edge of the feed arm support -5 (for long-hole) ❾.

Install feed guide shaft A-5 (for long-hole) ❽ to the bed so that the feed arm support -5 (for long-hole) ❾ moves smoothly.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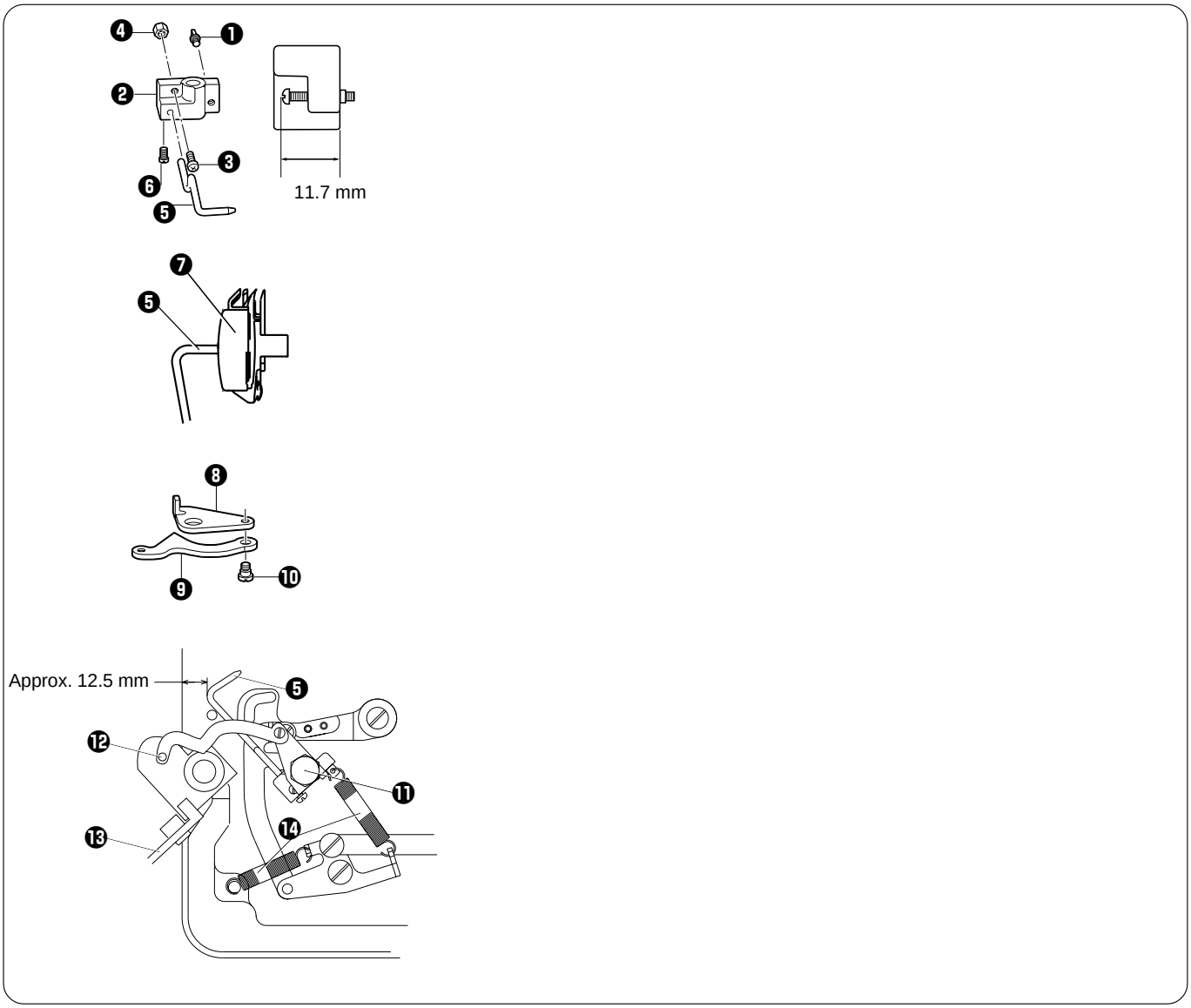
3-4. Bobbin presser mechanism



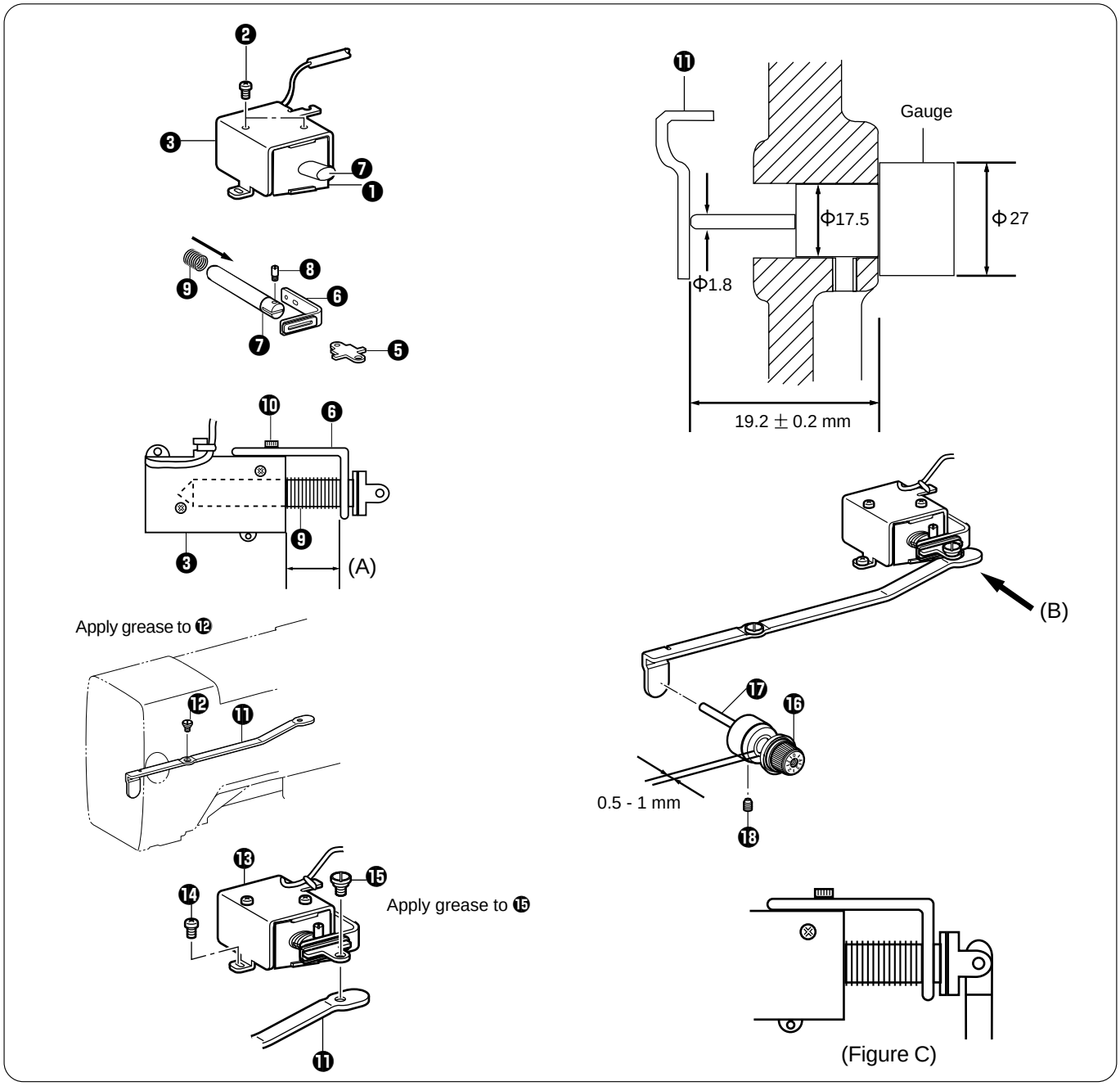
Install spring hook U ❶ to the bobbin presser bracket ❷. Install the screw ❸ and the nut ❹ to the bobbin presser bracket ❷. At this time, install the screw so that the length shown in the illustration is 11.7 mm. Install the bobbin presser ❺ to the bobbin presser bracket ❷ with the set screw ❻. At this time, install so that the end of the bobbin presser ❺ is at the center of the bobbin case ❼.

Install the auxiliary plate ❽ and the opening plate ❾ with the shoulder screw ❿.

Install the bobbin presser bracket ❷ and the auxiliary plate ❽ to the bed with the shoulder screw ⓫. Install the opening plate ❾ to the rotary hook cover ⓭ with the shoulder screw ⓬. Attach the two extension springs ⓮.

Turn on the power. After the mechanism moves to the home position, turn the screw ❸ and the nut ❹ to adjust so that the clearance between the bobbin presser ❺ and the edge of the bed is approximately 12.5 mm.

3-5. Tension release mechanism



(Figure C)

Install the tension release solenoid ❶ to the solenoid holder ❸ with the two screws ❷.

Pass the tension release solenoid link ❺ through the plate ❻. Install the tension release solenoid link ❺ to the plunger ❼ that was removed from the tension release solenoid ❶ using the plunger pin ❽.

Install the spring ❾ to the plunger ❼. Insert the plunger ❼ into the tension release solenoid ❶, and then install the plate ❻ to the solenoid holder ❸ with the bolt ❿ so that dimension (A) is 13.7 mm.

Install the tension release link ⓫ with the shoulder screw ⓬ from the face plate side.

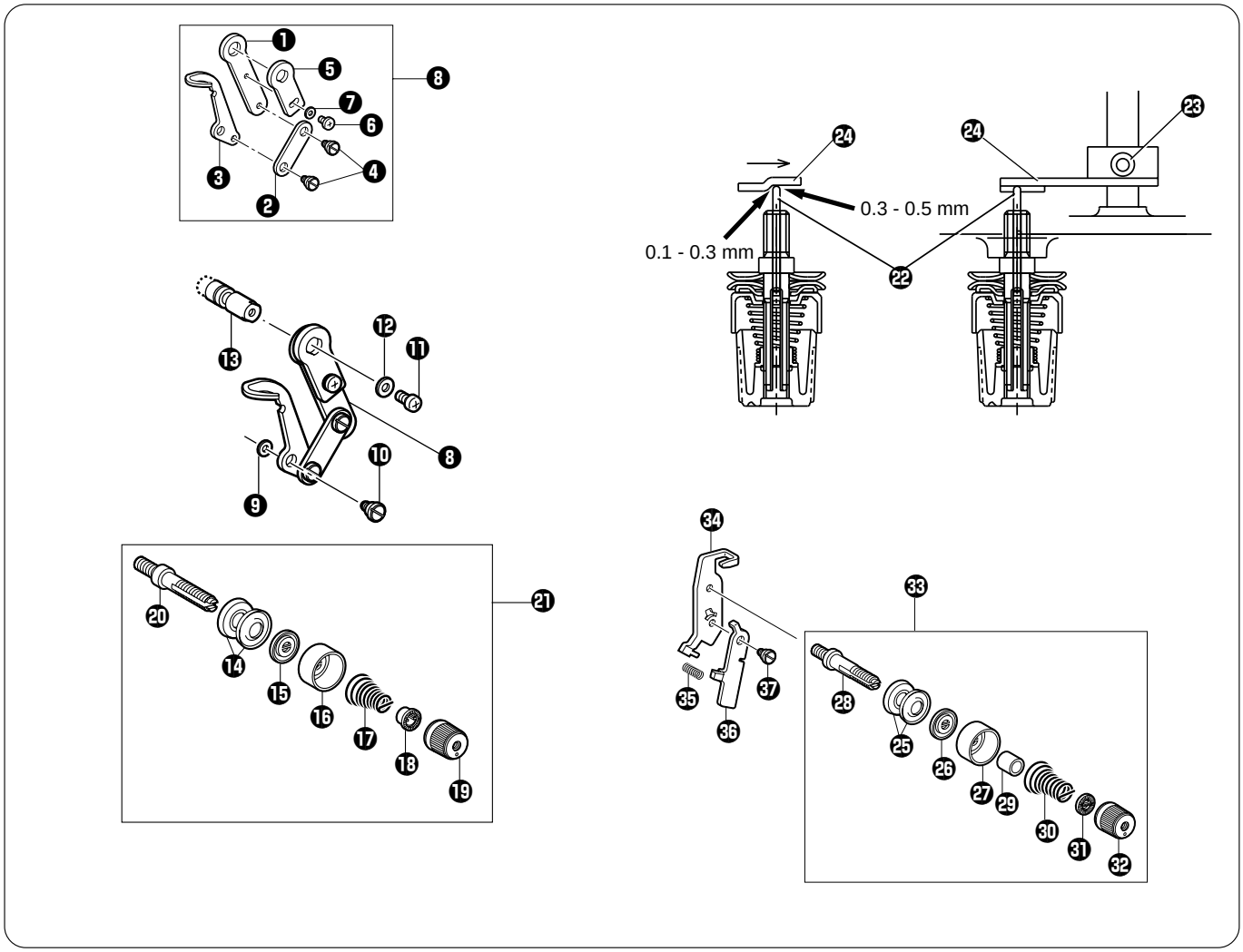
Provisionally install the tension release solenoid assembly ⓭ with the two screws ⓮. Connect the tension release solenoid assembly ⓭ and the tension release link ⓫ with the shoulder screw ⓯.

Adjust the position of the tension release solenoid assembly ⓭ so that the tension release link ⓫ protrudes from the edge of the tension stud bracket assembly ⓰ on the arm by 19.2 ± 0.2 mm. Then securely tighten the screw ⓮.

Insert the tension release pin ⓱ into the tension stud bracket assembly ⓰, and then insert it into the arm. Tighten the screw ⓲ so that the tension discs are open by 0.5 to 1 mm when the tension release link ⓫ is pushed in the direction of the arrow (B).

If not using a gauge, insert the tension release pin ⓱ into the tension stud bracket assembly ⓰, insert it into the arm, and then tighten the screw ⓲ at almost the center of the screw stop on the tension stud bracket assembly ⓰.

With the tension release link ⓫ pushed in the direction of the arrow (B) (Figure C), move the tension release solenoid assembly ⓭ so that the tension discs are open by 0.5 to 1 mm, and then tighten the screw ⓮.



Connect the adjusting lever ❶, lever link ❷ and tension take-up lever ❸ with the two shoulder screws ❹. Install the lever ❺ to the adjusting lever ❶ with the screw ❻ and the washer ❼. (Tension lever take-up assembly ❽)

Insert the washer ❾ into the bottom of the tension lever take-up assembly ❽, and then install the tension lever take-up assembly ❽ to the arm with the shoulder screw ❿. Install the tension lever take-up assembly ❽ to the tension release shaft ⓭ with the screw ⓫ and the washer ⓬.

Place the two tension discs ⓮, tension disc presser ⓯, tension disc presser ⓰, tension adjusting spring ⓱, washer ⓲ and tension nut ⓳ onto the sub tension stud ⓴. (Sub thread tension assembly ㉑)

Insert the tension release pin ㉒ into the sub thread tension assembly ㉑, and then install the sub thread tension assembly ㉑ to the arm.

To adjust the thread tension, turn on the power. After the mechanism moves to the home position, press the RESET key to lower the presser foot.

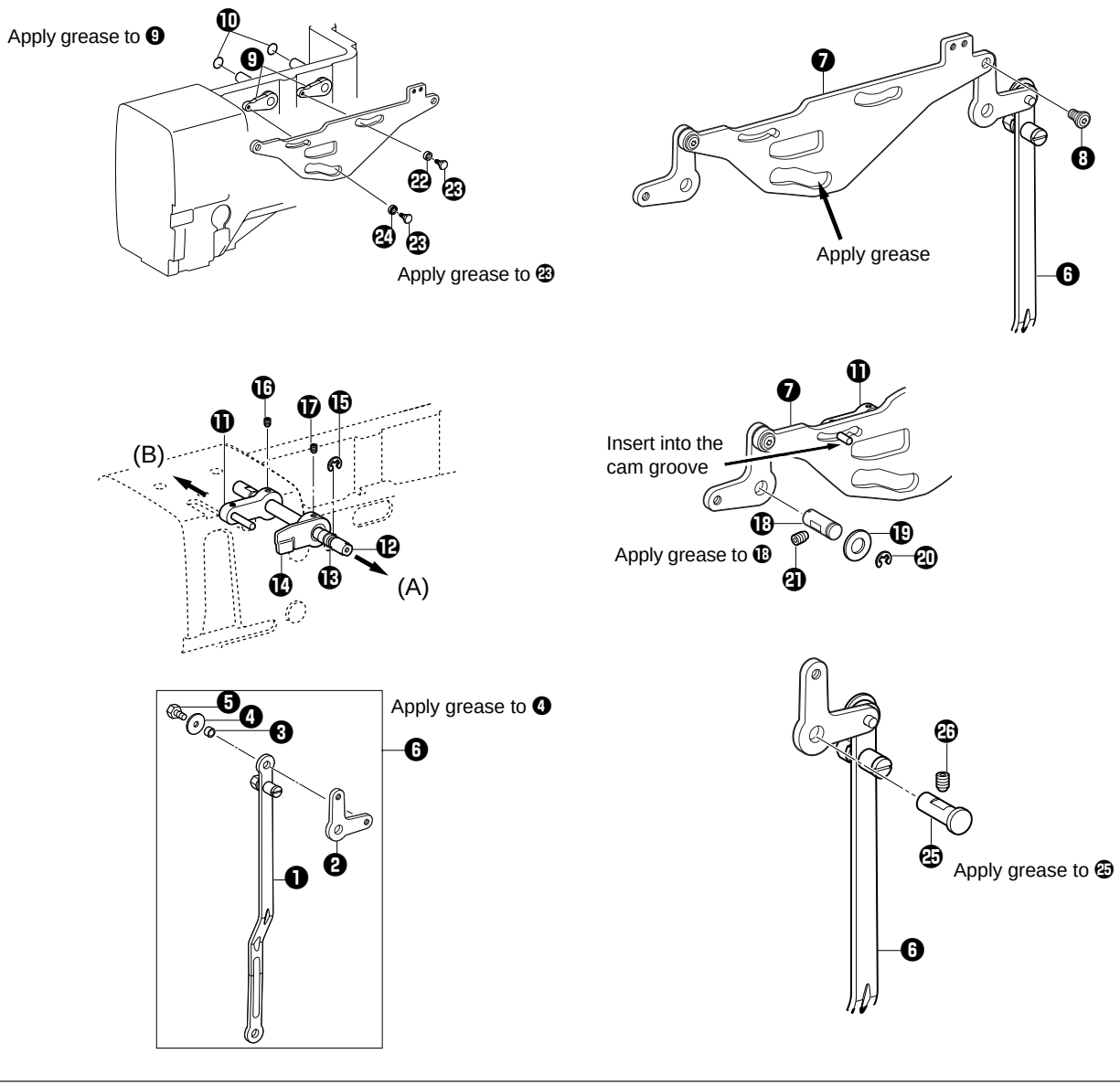
Loosen the screw ㉓, and then adjust the thread tension by adjusting the clearances between the tension release cam ㉔ and the tension release pin ㉒ as shown in the illustration.

Press the RESET key to raise the presser foot, and then check that the opening clearance between the tension discs is 0.5 to 1 mm. Then, press the RESET key again to lower the presser foot, and check that the tension discs are firmly closed.

Place the tension discs ㉕, tension disc presser ㉖ and tension disc presser ㉗ onto the tension stud ㉘. Place the collar ㉙ onto the tension stud ㉘ as far in as it will go. Place the tension spring ㉚ and the washer ㉛ onto the tension stud ㉘. Then tighten the tension nut ㉜. (Tension stud assembly ㉝)

Insert the tension release pin ㉒ into the tension stud assembly ㉝. Provisionally install the tension release lever bracket ㉞ to the tension stud assembly ㉝. Then attach the spring ㉟. Install the tension release lever ㊱ with the shoulder screw ㊲ so that the spring ㉟ is straight. Then fully tighten the tension stud assembly ㉝.

3-6. Presser lifter mechanism



Install the presser lifter connecting rod assembly ❶ and the knee lifter lever ❷ with the spacer ❸, plain washer D ❹ and bolt ❺. (Presser lifter connecting rod set ❻)

Install the presser lifter connecting rod set ❻ and the lifter shaft assembly ❼ with the shoulder screw ❽.

Insert the two trimmer driving levers ❾ to the inside of the arm. Pass the two O-rings ❿ into the shaft from the outside of the arm, and fit them into the hollow in the arm.

Insert the pin of the tension release driving lever ⓫ into the cam grove in the lifter shaft assembly ❼, and then insert into the arm.

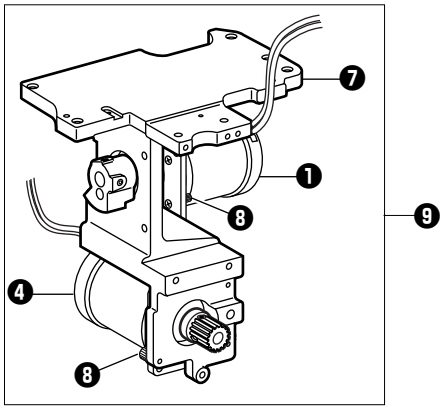
Install the O-ring ⓭ to the tension release shaft ⓬, and then insert into the arm. At this time, insert the tension release cam ⓮, pass the tension release driving lever ⓫ through the tension release cam ⓮, and then install the retaining ring ⓯.

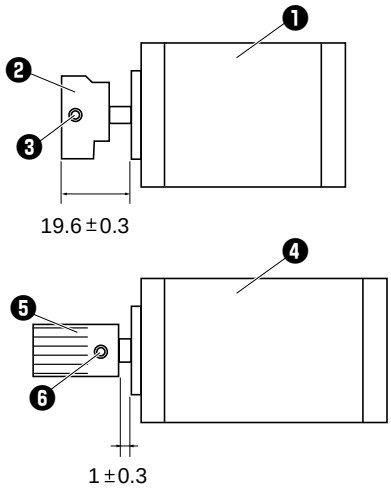
While pushing the tension release shaft ⓬ in the direction of the arrow (A), push the tension release driving lever ⓫ in the direction of the arrow (B) to align it with the screw stop on the tension release shaft ⓬, and secure by tightening the set screw ⓰. Then secure the tension release cam ⓮ by tightening the set screw ⓱.

Install the lifter shaft ⓲, small plain washer 8 ⓳ and retaining ring E6 ⓴ to the arm. Secure by tightening the set screw ㉑.

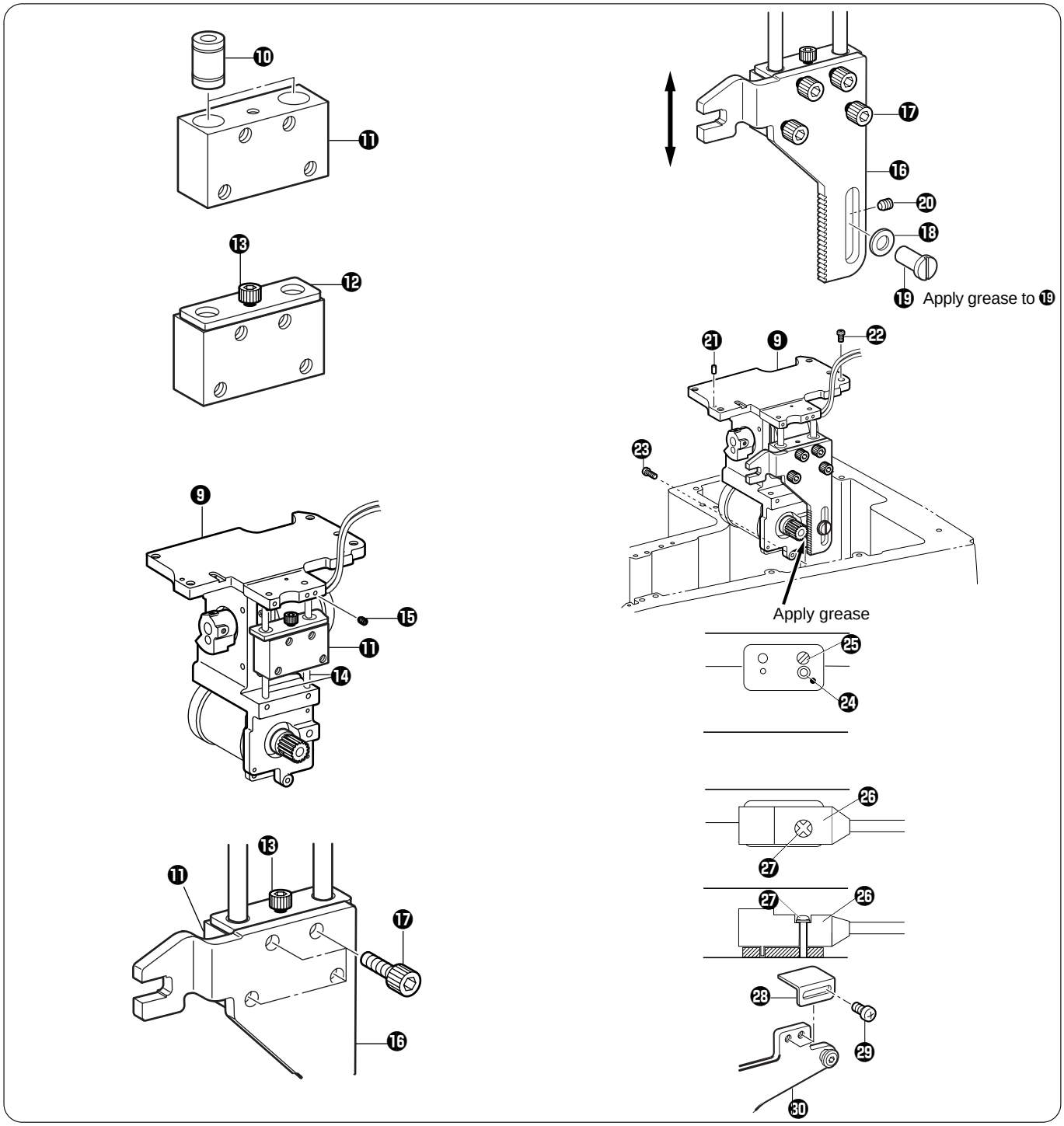
Install the driving lever roller ㉒ to the trimmer driving lever ❾ with the shoulder screw ㉓. Install the ball bearing ㉔ to the trimmer driving lever ❾ with the shoulder screw ㉓.

Install the presser lifter connecting rod set ❻ to the arm with lifter shaft A ㉕ and the set screw ㉖.





Install the motor lever ❷ to the pulse motor N assembly (for needle zigzag) ❶ with the set screw ❸ so that the dimensions are as shown in the illustration.
Install the gear 15.75 ❺ to the pulse motor FT assembly (for presser lifter) ❹ with the set screw ❻ so that the dimensions are as shown in the illustration.
Install the pulse motor N assembly (for needle zigzag) ❶ and the pulse motor FT assembly (for presser lifter) ❹ to the motor bracket ❼ with the bolts ❽ so that the directions of the cords are as shown in the illustration. (Motor bracket assembly ❾)



Insert the two linear ball bearings ⑩ into the guide bracket ⑪.

Provisionally install the bearing holder ⑫ with the bolt ⑬.

Pass the two guide shafts ⑭ though the motor bracket assembly ⑨ and the guide bracket ⑪. Secure the guide shafts ⑭ by tightening the four set screws ⑮.

Provisionally install the presser driving arm ⑯ to the guide bracket ⑪ with the four bolts ⑰. Then securely tighten the bolt ⑬.

Insert the washer ⑱ into the driving arm presser ⑲, and then pass it through the presser driving arm ⑯ and insert into the motor bracket assembly ⑨.

Provisionally tighten the set screw ⑳. Then tighten the bolt ⑰ and the set screw ⑳ so that the presser driving arm ⑯ moves up and down easily and so that there is no play in the gear.

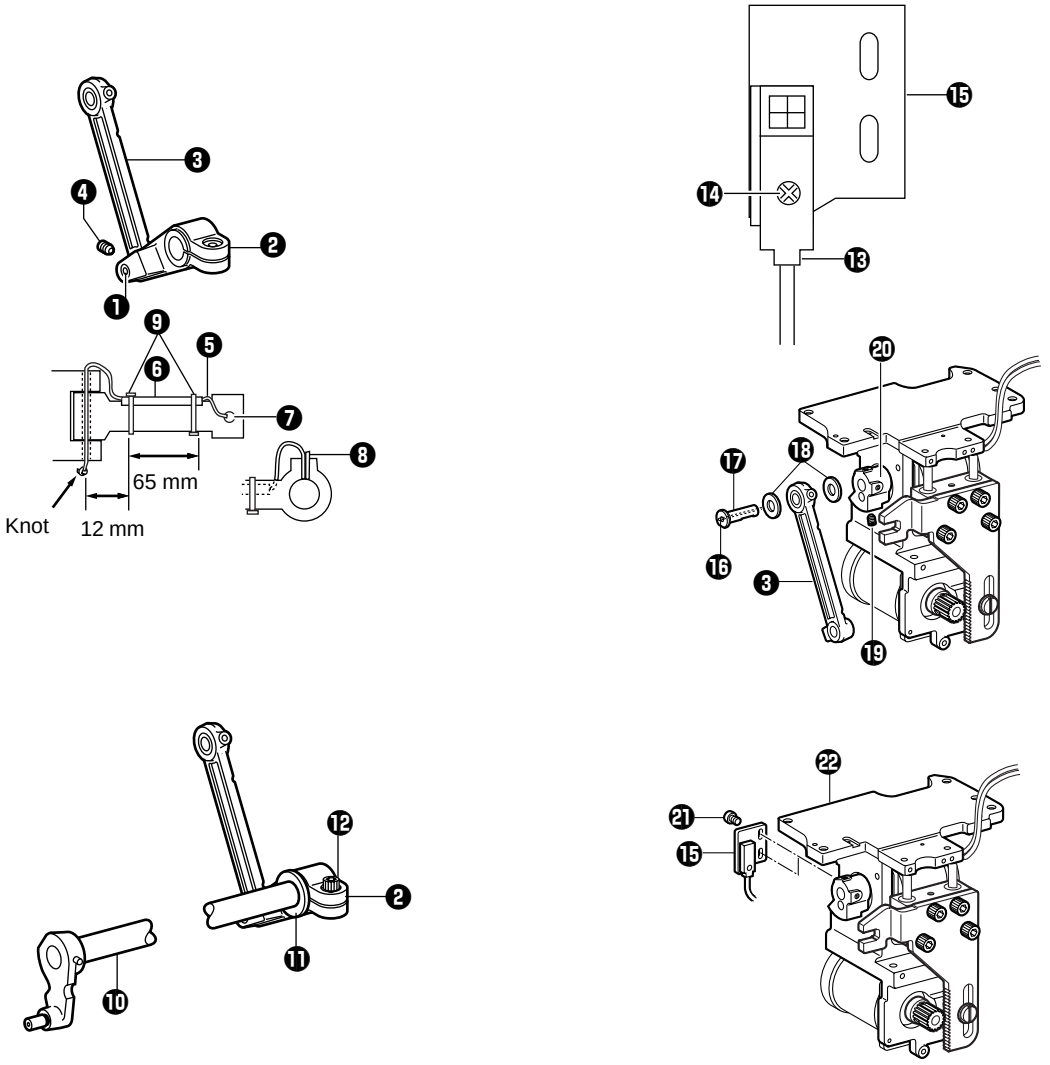
Insert the motor bracket assembly ⑨ into the arm from the top. Position it using the two positioning pins ㉑, and then install it by tightening the four screws ㉒ and the screw ㉓.

Install the clamp sensor plate ㉔ with the pan screw ㉕.

Install the sensor ㉖ with the screw ㉗.

Install the clamp sensor dog ㉘ to the upper thread trimmer driving link ㉚ with the two screws ㉙.

3-7. Needle zigzag mechanism



Pass the zigzag connecting rod shaft ❶ through the zigzag lever ❷ and zigzag connecting rod ❸, and then secure it by tightening the set screw ❹.

Pass the wick ❺ through the zigzag connecting rod shaft ❶ and the oil tube ❻, and then push it into the lubricating hole ❼. Push the felt ❽ into the lubricating hole ❼ to prevent the oil tube ❻ from coming out. Install the two fastening bands ❾ so that they face in the position shown in the illustration.

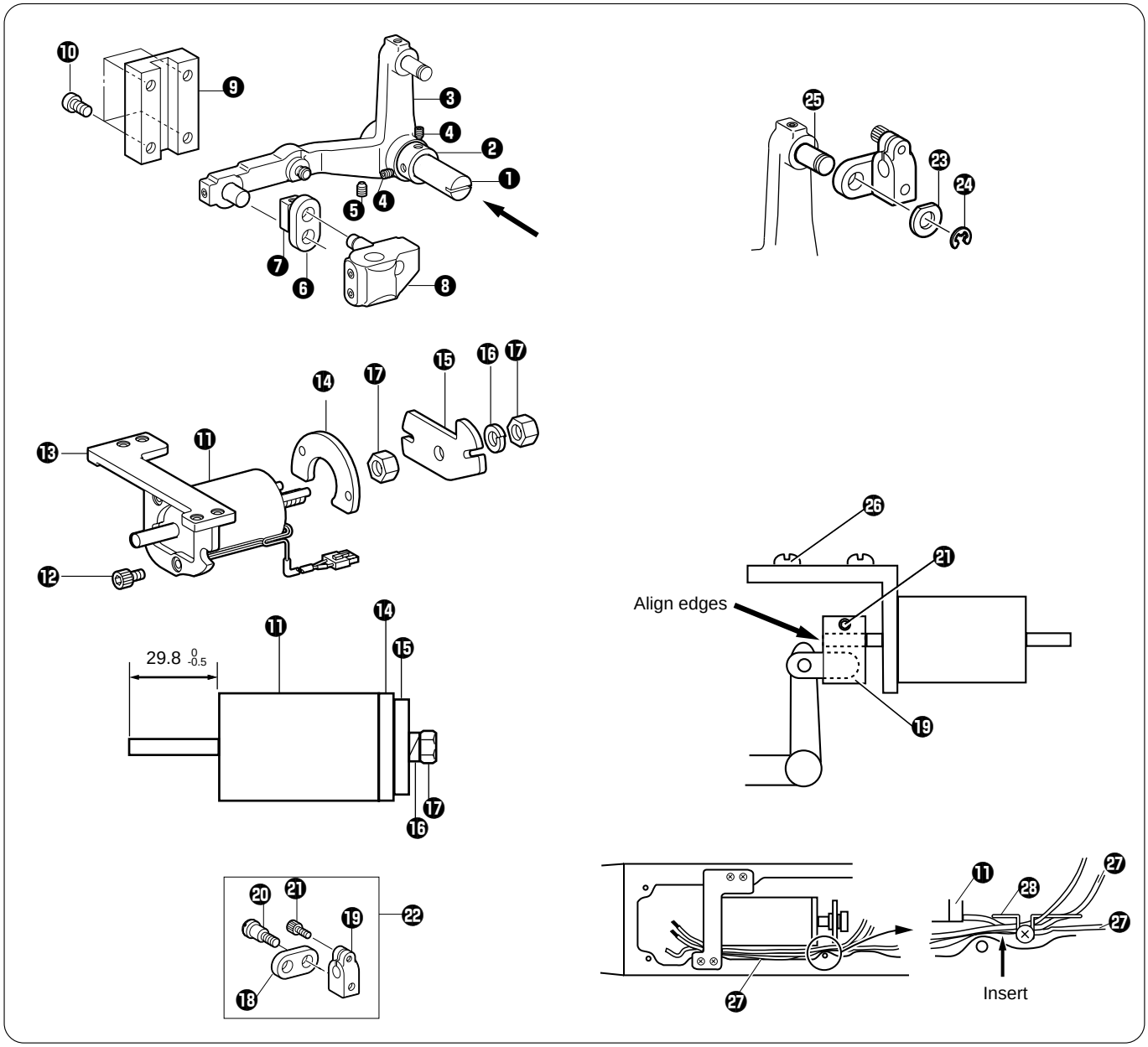
Pass zigzag lever assembly F ❿ through the arm, and position it in the thrust direction using the thrust washer ⓫ and the zigzag lever ❷. Then secure zigzag lever assembly F ❿ by tightening the bolt ⓬.

Install the sensor ⓭ to the zigzag sensor plate ⓯ with the screw ⓮.

Insert the wick ⓰ into the motor lever shaft ⓱. Place the washers ⓲ onto the motor lever shaft ⓱. Pass the motor lever shaft ⓱ through the zigzag connecting rod ❸ and the washers ⓲ so that the screw stop is aligned correctly, and then secure to the motor lever ⓴ by tightening the set screw ⓳.

Install the zigzag sensor plate ⓯ to the motor bracket ㉒ with the screw ㉑ so that the screw ㉑ is in the middle of the slot.

3-8. Cutter mechanism



Pass the cutter driving arm shaft ❶ through the set screw collar ❷ and the cutter driving arm assembly ❸ in the direction shown in the illustration. Secure the set screw collar ❷ with the two set screws ❹ so that the screw stops are aligned correctly. Install the cutter driving arm assembly ❸ with the set screw ❺ so that there is no play in the thrust direction and so that there is no gap. Install the cutter bar guide ❾ with the four screws ❿. Install the cutter driving link ❻ and the needle bar bracket slide block ❼ to the driving shaft holder assembly ❽. Install the other cutter driving link ❻ to the cutter driving arm assembly ❸.

Install the stopper cushion ⓮ to the cutter solenoid ⓫. Install the solenoid stopper ⓯ to the solenoid plunger with the spring washer ⓰ and two nuts ⓱ as shown in the illustration. Install the cutter solenoid ⓫ to the cutter solenoid bracket ⓭ with the three bolts ⓬. At this time, install so that the oil tube ㉗ passes underneath the cutter solenoid bracket ⓭.

Connect the cutter driving link ⓲ and the cutter link bracket ⓳ with the shoulder screw ⓴. Provisionally install the bolt ㉑. (Cutter link bracket assembly ㉒)

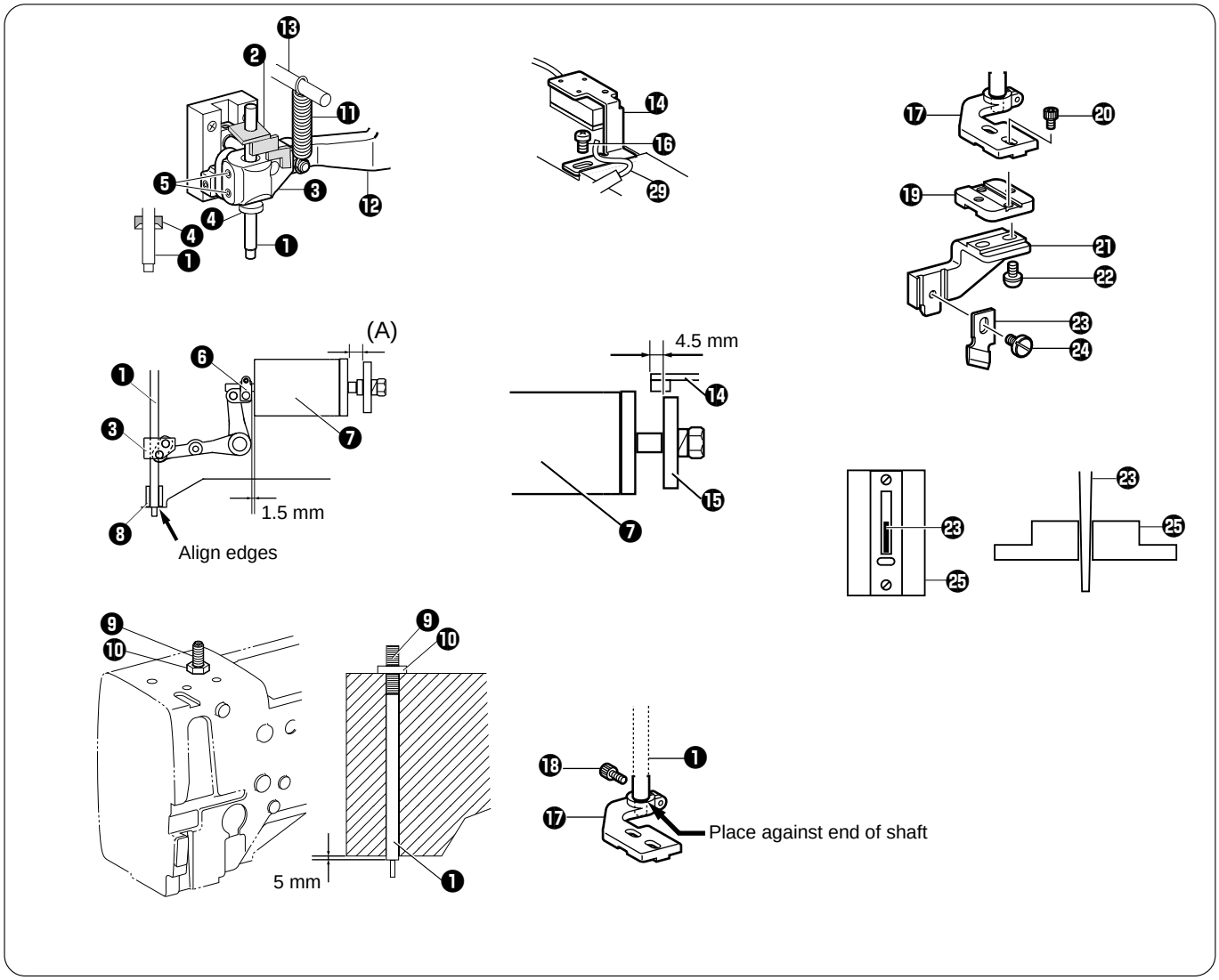
Install the cutter link bracket assembly ㉒ to the cutter link shaft ㉕ with the washer ㉓ and retaining ring E6 ㉔.

Insert the solenoid plunger into the cutter link bracket ⓳. Then tighten the bolt ㉑ so that the end of the solenoid plunger is aligned with the edge of the cutter link bracket ⓳.

Install the cutter solenoid bracket ⓭ to the arm with the four screws ㉖.

Check that the plunger of the cutter solenoid ⓫ moves easily.

Insert the oil tube ㉗ and the cord of the cutter solenoid ⓫ in between tube support U ㉘ and the arm.



Insert the cutter driving shaft ❶ into the arm from the top, and then pass it through the holes in the felt ❷ and the driving shaft holder assembly ❸. Pass the cutter driving shaft ❶ through the oil rejector ❹. Provisionally secure the driving shaft holder assembly ❸ with the two set screws ❺.

Fully tighten the set crews ❺ so that the edges of the cutter driving shaft ❶ and the bush ❽ are aligned when the clearance between the edges of the cutter link bracket ❻ and the cutter solenoid ❼ is 1.5 mm (or when dimension (A) is 15.5 mm).

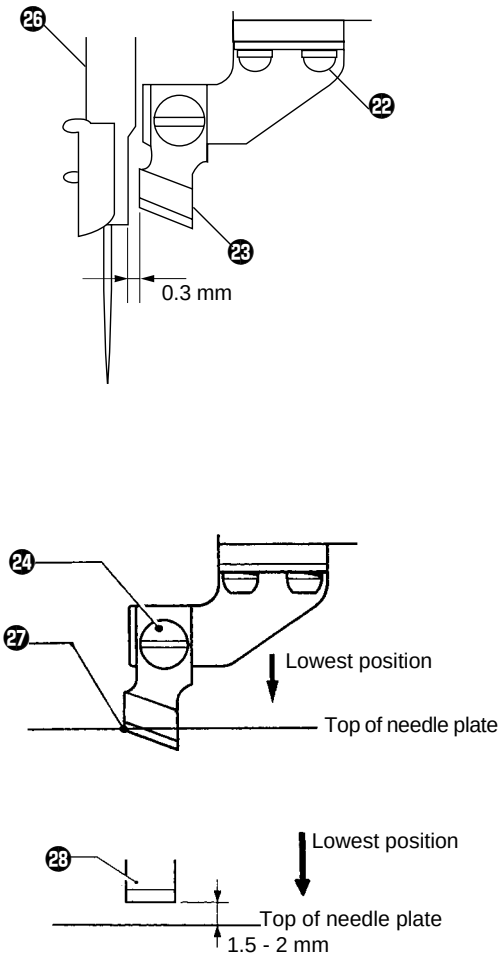
Install the screw assembly ❾ to the arm, and secure it with the nut ❿ so that the stepped section of the cutter driving shaft ❶ protrudes by 5 mm from the processed surface of the arm jaw.

Attach the spring ⓫ to the cutter driving arm assembly ⓬ and the tension release shaft ⓭.

Install the knife sensor assembly ⓮ with the screw ⓰ so that the clearance between the knife sensor assembly ⓮ and the solenoid stopper ⓯ is 4.5 mm. At this time, be careful not to clamp the wick ㉙.

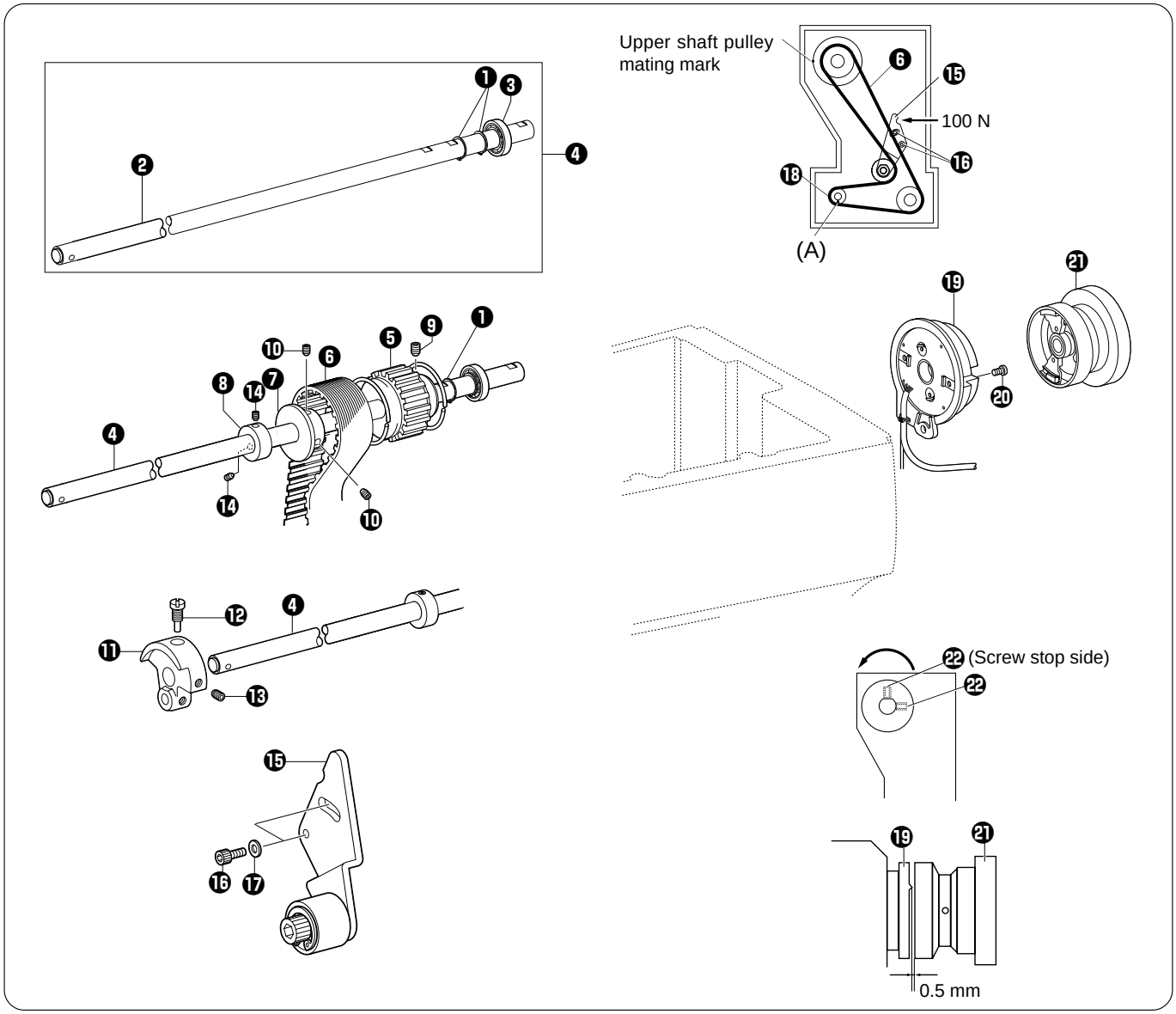
Install the cutter holder ⓱ to the cutter driving shaft ❶ with the bolt ⓲.

Provisionally install cutter holder M ⓳ to the cutter holder ⓱ with the bolt ⓴. Provisionally install cutter holder DL ㉑ to cutter holder M ⓳ with the screw ㉒. Install the cutter ㉓ to cutter holder DL ㉑ with the screw ㉔. Fully tighten the bolts ⓲ and ⓴ so that the cutter ㉓ is in the center of the cutter groove in the needle plate ㉕ when the cutter is lowered.



Tighten the screw ㉒ so that the distance between the needle bar ㉖ and the cutter ㉓ is 0.3 mm.
Tighten the screw ㉔ so that the top of the cutter blade and the top of the needle plate are aligned when the cutter ㉓ is pushed down manually to its lowest position.
For a flat cutter ㉘, tighten the screw ㉔ so that it is 1.5 to 2 mm from the top of the needle plate.

3-9. Upper shaft and tension pulley mechanism



Install the two retaining rings ❶ to the upper shaft ❷. Press-fit the ball bearing ❸ as far as the retaining rings ❶. (Upper shaft assembly ❹)

Place the timing pulley U assembly ❺, timing belt ❻, bobbin winder pulley ❼ and set screw collar assembly ❽ onto the upper shaft assembly ❹. While pushing the timing pulley U assembly ❺ against the retaining rings ❶, secure it by tightening the set screw ❾. While pushing the bobbin winder pulley ❼ against the timing pulley U assembly ❺, secure it by tightening the two set screws ❿.

Install the thread take-up crank ⓫ to the upper shaft assembly ❹ with the screw ⓬ and the set screw ⓭.

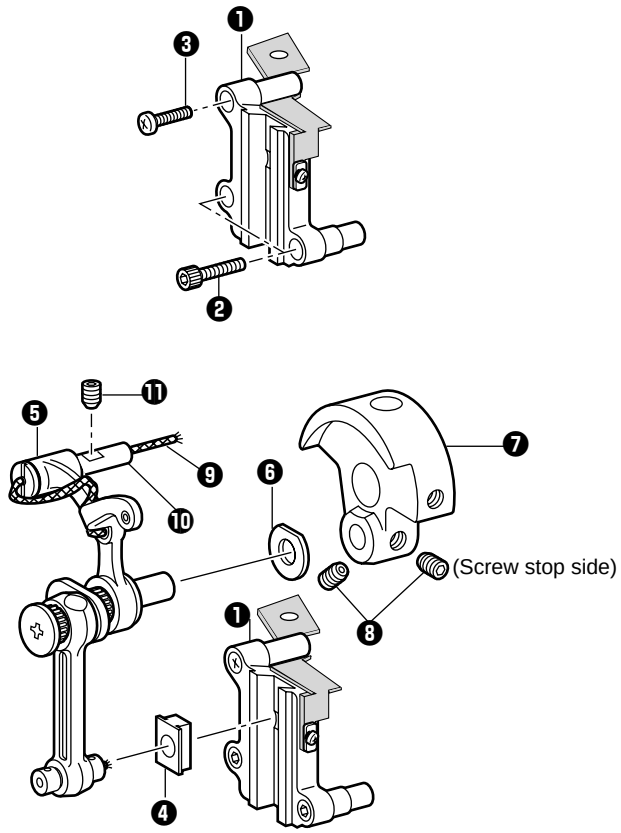
Secure the set screw collar assembly ❽ to the upper shaft assembly ❹ using the thread take-up crank ⓫ and the two set screws ⓮ so that there is no play.

Provisionally install the tension pulley assembly ⓯ with the two bolts ⓰ and the two plain washers ⓱. Set the phase between the upper shaft and the lower shaft so that the mating mark (A) on the lower shaft timing pulley ⓲ is facing straight down when the upper shaft assembly ❹ is at the needle up stop position. While pushing the tension pulley assembly ⓯ with a force of 100 N, secure it by tightening the two bolts ⓰.

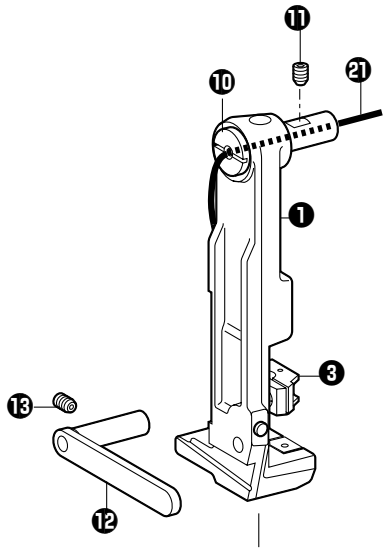
Install the synchronizer assembly H80 ⓳ to the arm with the screw ⓴.

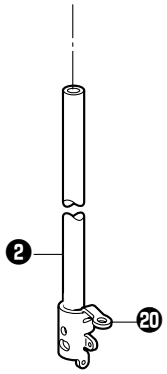
Install the pulley assembly ㉑ with the screw ㉒ so that the screw stop is at the front, and so that the clearance between it and the synchronizer assembly H80 ⓳ is 0.5 mm.

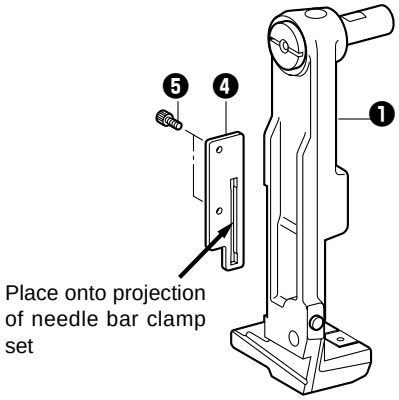
3-10. Needle bar and thread take-up mechanism

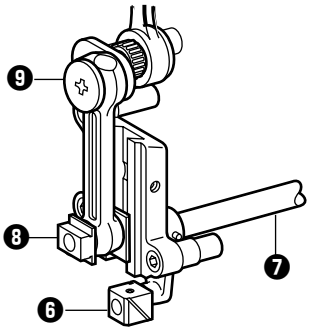


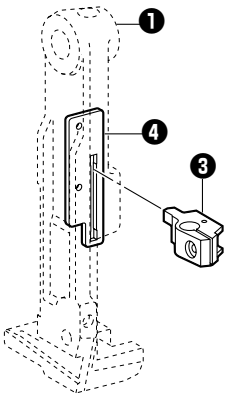
Install the crank rod guide ❶ with the two bolts ❷ and the screw ❸.
Install the needle bar bracket slide block ❹ to the thread take-up lever set ❺. Pass the wick ❾ through the support shaft hole in the arm. Insert the washer ❻ into the thread take-up lever set ❺, and then install it to the thread take-up crank ❼. Insert the needle bar bracket slide block ❹ into the groove in the crank rod guide ❶. Secure the thread take-up lever set ❺ by tightening the two set screws ❽.
Insert the support shaft ❿ and secure it by tightening the set screw ⓫ so that the thread take-up moves smoothly with no play.

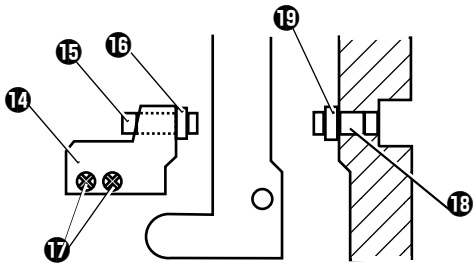












Insert the needle bar ❷ into the needle bar bracket assembly ❶, and then pass it through the needle bar clamp ❸ as shown in the illustration.

Set the projection of the needle bar clamp ❸ into the groove in the needle bar guide ❹, and then install to the needle bar bracket assembly ❶ with the bolt ❺ so that the needle bar ❷ moves smoothly.

Insert the slide block ❻ of the needle bar bracket assembly ❶ into the zigzag lever shaft ❼, and insert the slide block ❽ of the needle bar clamp ❸ into the thread take-up lever set ❾.

Insert the needle bar bracket assembly ❶ into the arm, and then install it while inserting each of the slide blocks.

Pass the wick ㉑ of the needle bar bracket support shaft ⓾ through the arm.

Insert the needle bar bracket support shaft ⓾, and then secure it by tightening the set screw ⓫ so that there is no play in the needle bar bracket assembly ❶.

Insert the needle bar bracket guide ⓬ into the arm, and then secure it by tightening the set screw ⓭ so that there is no play in the needle bar bracket assembly ❶.

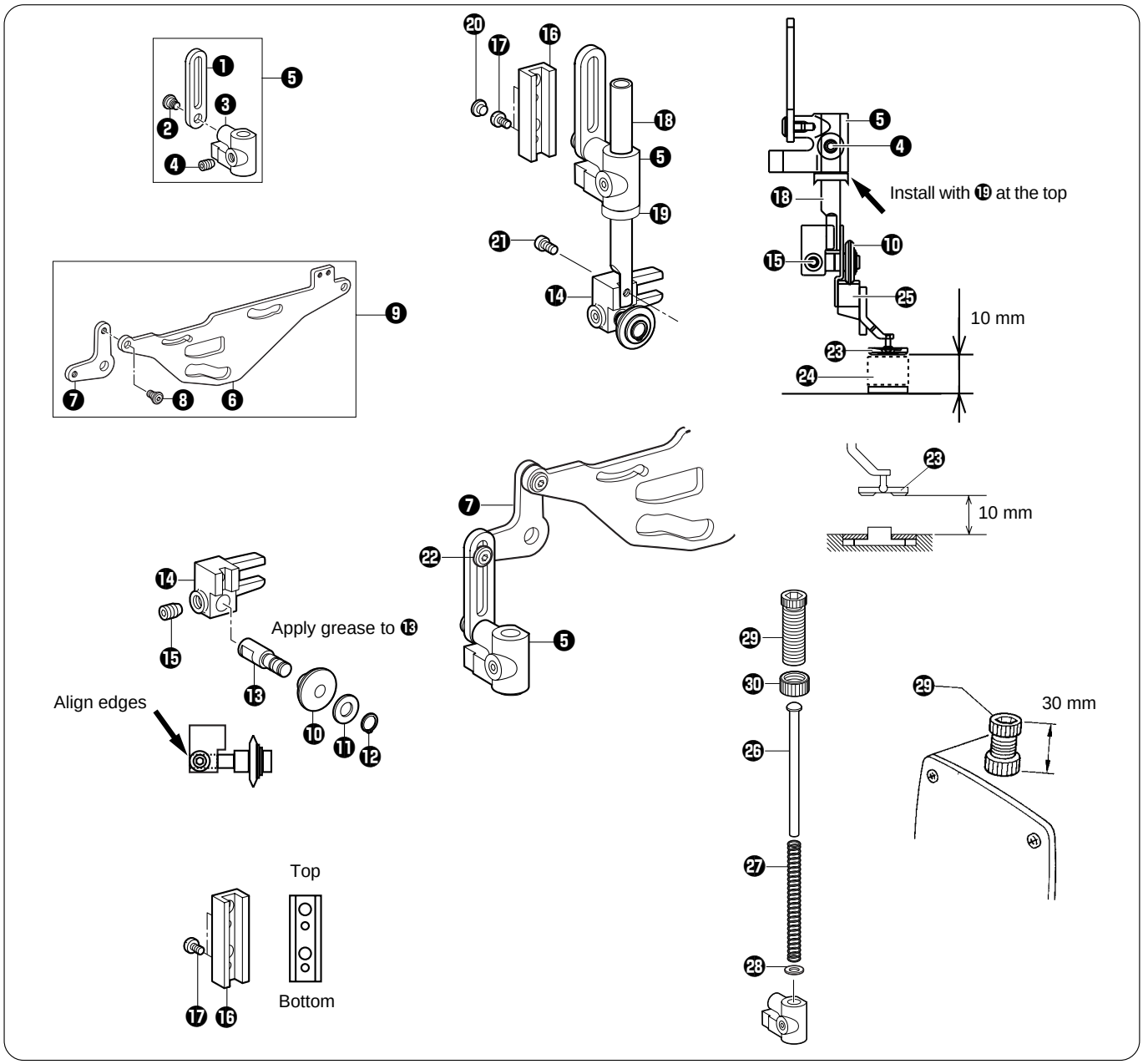
Install the set screw ⓯ and nut ⓰ to the stopper ⓮, and then install it to the arm with the screw ⓱.

Install the set screw ⓲ and nut ⓳ to the arm.

When the needle bar ❷ is at its maximum zigzag position, tighten the set screws ⓯ and ⓲ against the needle bar bracket assembly ❶, and then loosen them again by about 1/4 of a turn each. Then tighten the nuts ⓰ and ⓳.

Insert the needle bar thread guide ⓴ into the needle bar ❷.

3-11. Presser bar mechanism



Install the presser bar lifter link ❶ to the presser bar guide bracket ❸ with the shoulder screw ❷. Install the set screw ❹ to the presser bar guide bracket ❸. (Presser bar guide bracket assembly ❺)

Install the upper thread trimmer driving link ❻ and the knee lifter lever ❼ with the shoulder screw ❽. (Lifter shaft assembly ❾)

Install the roller ❿ to the roller shaft ⓭ with the plain washer ⓫ and the retaining ring ⓬. Install the roller shaft ⓭ to the presser roller bracket ⓮. Secure the roller shaft ⓭ by tightening the set screw ⓯.

Provisionally install the needle bar guide ⓰ to the arm with the screw ⓱ as shown in the illustration.

Insert the presser bar ⓲ into the arm, and then pass it through the oil rejector ⓳ and the presser bar guide bracket assembly ❺.

Position the needle bar guide ⓰ so that the presser bar ⓲ moves smoothly, and then secure it by tightening the screw ⓱. Tap in the rubber cap ⓴. Install the presser roller bracket ⓮ to the presser bar ⓲ with the screw ㉑.

Connect the presser bar guide bracket assembly ❺ and the knee lifter lever ❼ with the shoulder screw ㉒.

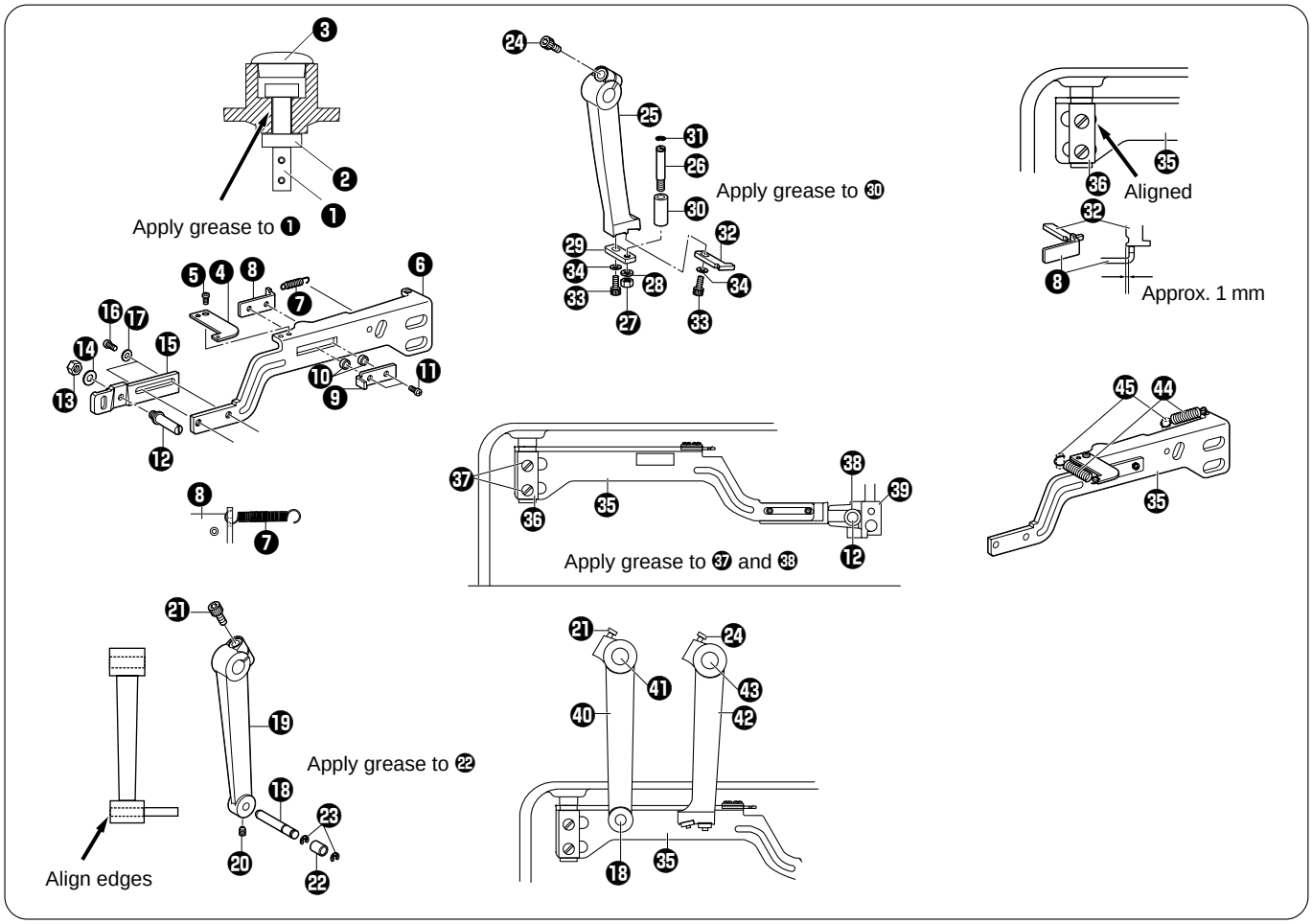
Place a 10 mm gauge ㉔ underneath the work clamp ㉓.

Turn on the power. After the mechanism moves to the home position, check that the setting for memory switch No. 05 (presser foot height at neutral position) is 10 mm. (If it is not set to 10 mm, set it to 10 mm.)

While pushing the presser bar ⓲ down from above, tighten the set screw ❹ so that the roller ❿ is not at an angle to the V-shaped groove in the presser arm ㉕. Then remove the gauge ㉔ and turn off the power.

Insert the spring guide ㉖, compression spring ㉗ and plain washer ㉘, and with the presser adjusting screw ㉙ at a height of 30 mm, tighten the presser adjusting nut ㉚.

3-12. Upper thread trimmer mechanism



Insert the upper thread trimmer fulcrum shaft ❶ into the arm. Secure the upper thread trimmer fulcrum shaft ❶ with the set screw collar assembly ❷ so that it turns smoothly. Install the rubber cap ❸ from the top of the arm.

Install the spring hook plate ❹ to the upper thread trimmer lever assembly ❻ with the screw ❺. Attach the spring ❼ to the stop plate ❽ as shown in the illustration. Install the back plate ❾ and the stop plate ❽ to the upper thread trimmer lever assembly ❻ with the two collars ❿ and the two screws ⓫. Apply grease to the sliding surfaces.

Install the support stud ⓬ to the setting plate ⓯ with the nut ⓭ and the plain washer ⓮. Install the setting plate ⓯ to the upper thread trimmer lever assembly ❻ with the screw ⓰ and the plain washer ⓱.

Press-fit the longitudinal feed arm pin ⓲ onto the longitudinal feed arm ⓳. Secure it by tightening the set screw ⓴. Install the bolt ㉑. Place the longitudinal feed arm roller ㉒ onto the longitudinal feed arm pin ⓲ and secure it with the two retaining rings ㉓. (Longitudinal feed arm assembly)

Install the eye bolt ㉔ to the trimmer driving arm ㉕. Install the roller shaft ㉖ to the support plate ㉙ with the nut ㉗ and the spring washer ㉘. Place the driving arm roller ㉚ onto the roller shaft ㉖. Secure the driving arm roller ㉚ with the retaining ring ㉛. Install the support plate ㉙ and the stopper ㉜ to the trimmer driving arm ㉕ with the eye bolts ㉝ and the plain washers ㉞. (Trimmer driving arm assembly)

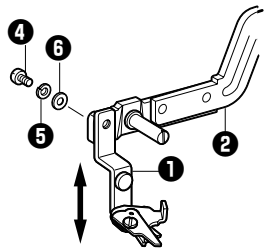
Install the upper thread trimmer lever set ㉟ to the upper thread trimmer fulcrum shaft ❶ with the two washers ㊱ and shoulder screws ㊲. Place the roller ㊳ onto the support stud ⓬ of the upper thread trimmer lever set ㉟, and then place it into the groove in the presser roller bracket ㊴.

Pass the longitudinal feed arm pin ⓲ of the longitudinal feed arm assembly ㊵ through the upper thread trimmer lever set ㉟, and provisionally install it to the trimmer driving lever ㊶ with the eye bolt ㉑. Provisionally install the trimmer driving arm assembly ㊷ to the trimmer driving lever ㊸ with the eye bolt ㉔.

Turn on the power. After the mechanism moves to the home position, press the RESET key to lower the presser foot.

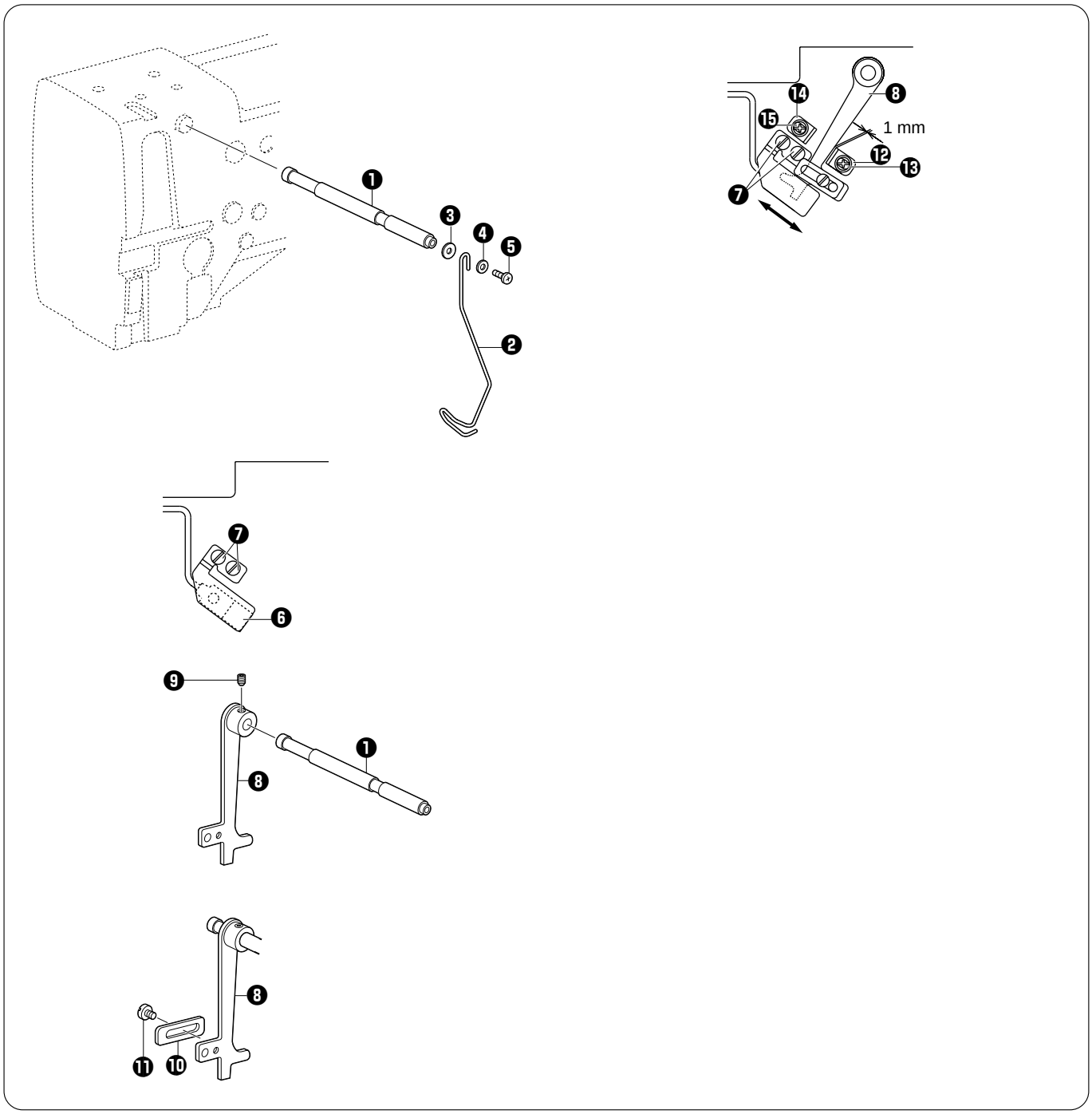
Tighten the eye bolt ㉑ of the longitudinal feed arm assembly ㊵ so that the slot of the upper thread trimmer lever set ㉟ and the edge of the washer ㊱ are aligned. Tighten the eye bolt ㉔ so that the stop plate ❽ and the stopper ㉜ are in the positions shown in the illustration.

Attach the two springs ㊹ to the upper thread trimmer lever set ㉟. Attach the larger hooks of the springs ㊹ to the pins ㊺ on the arm.



Install the upper thread trimmer assembly ❶ to the upper thread trimmer lever ❷ with the screw ❹, spring washer ❺ and plain washer ❻.

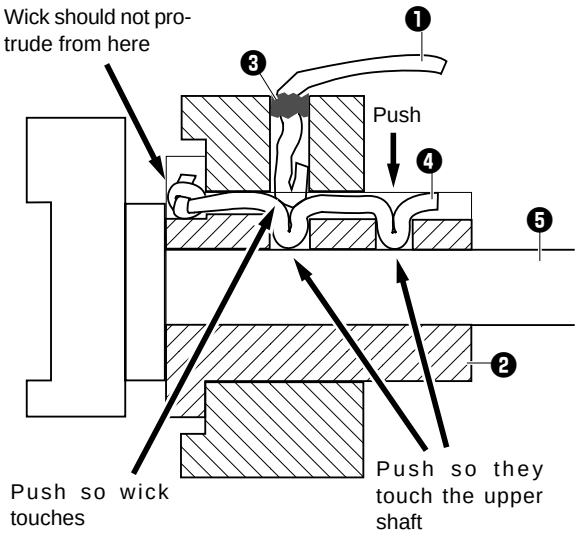
3-13. Thread breakage detection mechanism



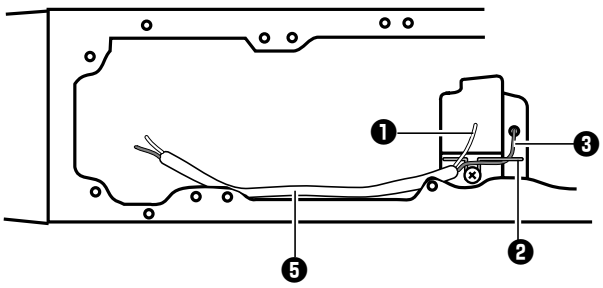
Provisionally install the thread guide ❷ to the thread breakage perceiving shaft ❶ with the plain washer ❸, plain washer ❹ and screw ❺, and then insert the thread breakage perceiving shaft ❶ into the arm.
Provisionally install the thread breakage sensor assembly ❻ with the two screws ❼.
Secure the cutter bar fixing plate ❽ to the thread breakage perceiving shaft ❶ with the set screw ❾.
Install the balancer ❿ to the cutter bar fixing plate ❽ with the screw ⓫.
Install the lever stopper ⓬ at the correct angle with the screw ⓭. Provisionally install the lever stopper ⓮ with the screw ⓯.

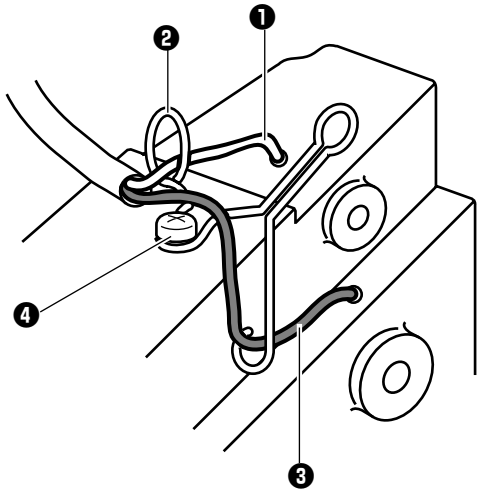
3-14. Lubrication mechanism

Shaft bush mechanism



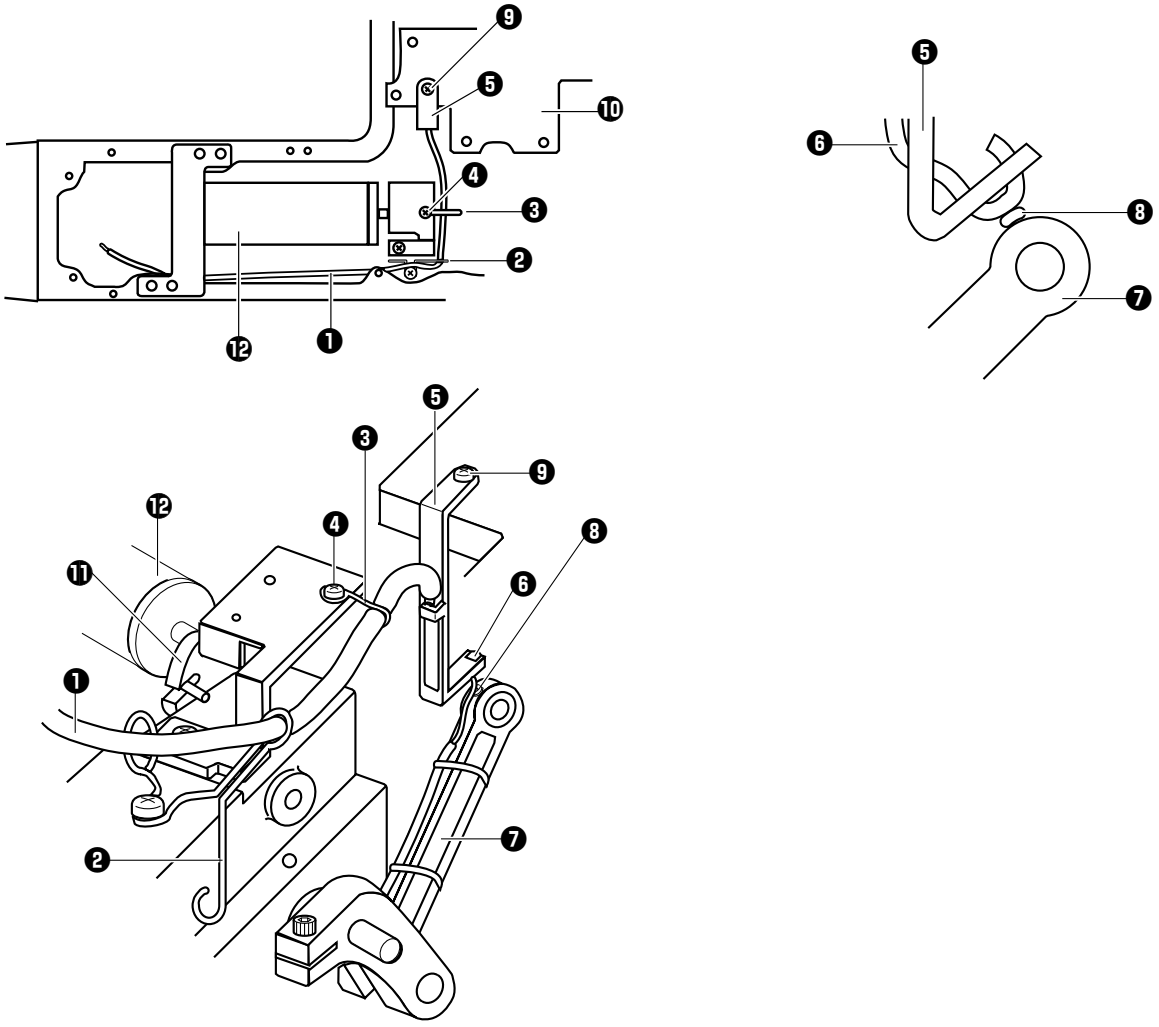
Insert the wick ❶ into bush F ❷. Insert the felt ❸ to stop the wick ❶ from coming out.
At this time, push in firmly so that the wick ❹ inside bush F ❷ is touching the wick ❶ and is also touching the upper shaft ❺.
* If the wick is not pushed in firmly enough, seizure of the upper shaft may occur.





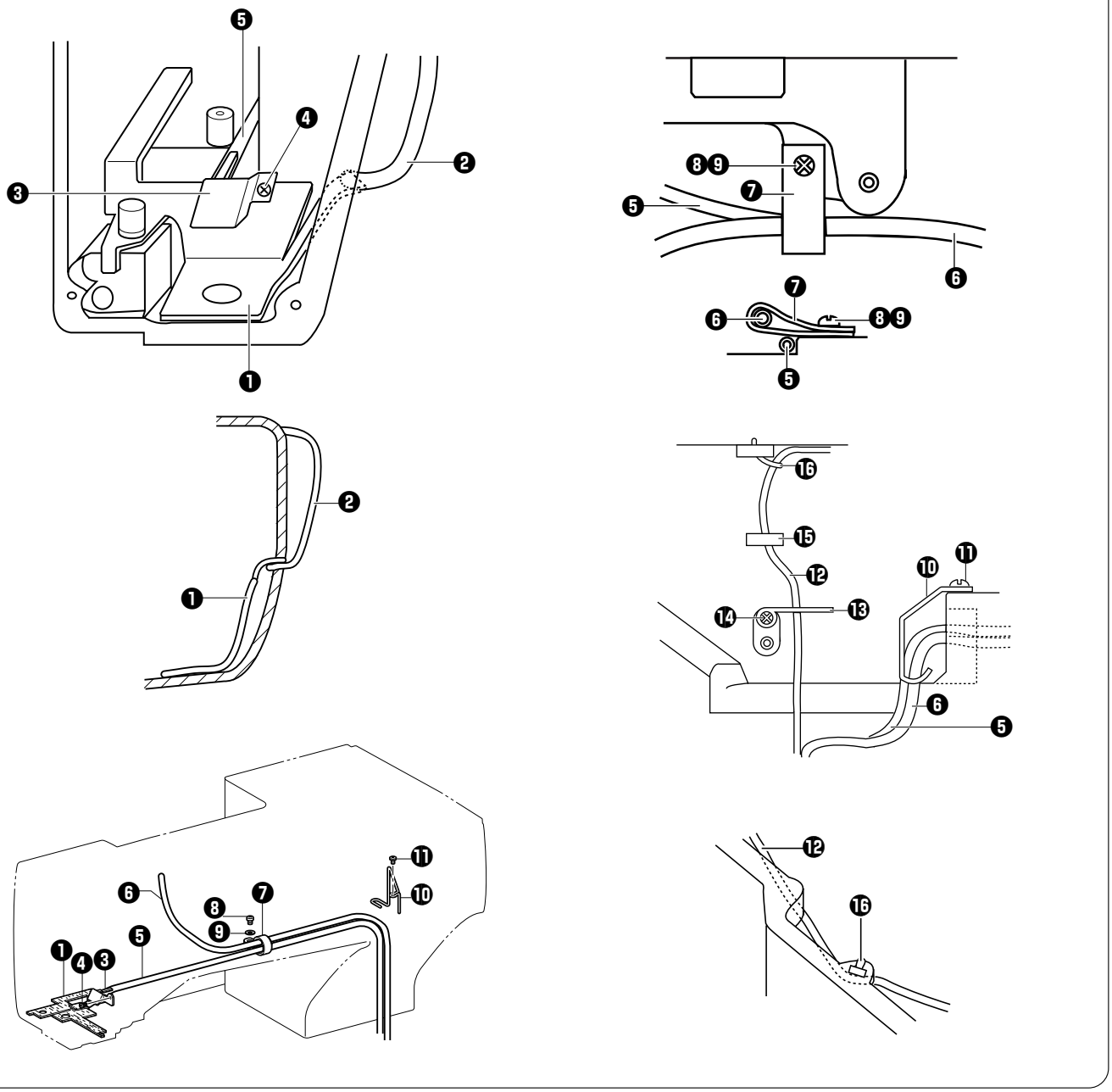
Pass the wick ❶ through tube support U ❷ and push it firmly into the upper shaft lubrication hole. Pass the wick ❸ through tube support U ❷ and push it firmly into the zigzag lever shaft lubrication hole.
Install tube support U ❷ with the screw ❹. Pass the oil tube ❺ around the outside of tube support U ❷ as shown in the illustration.

Needle zigzag mechanism



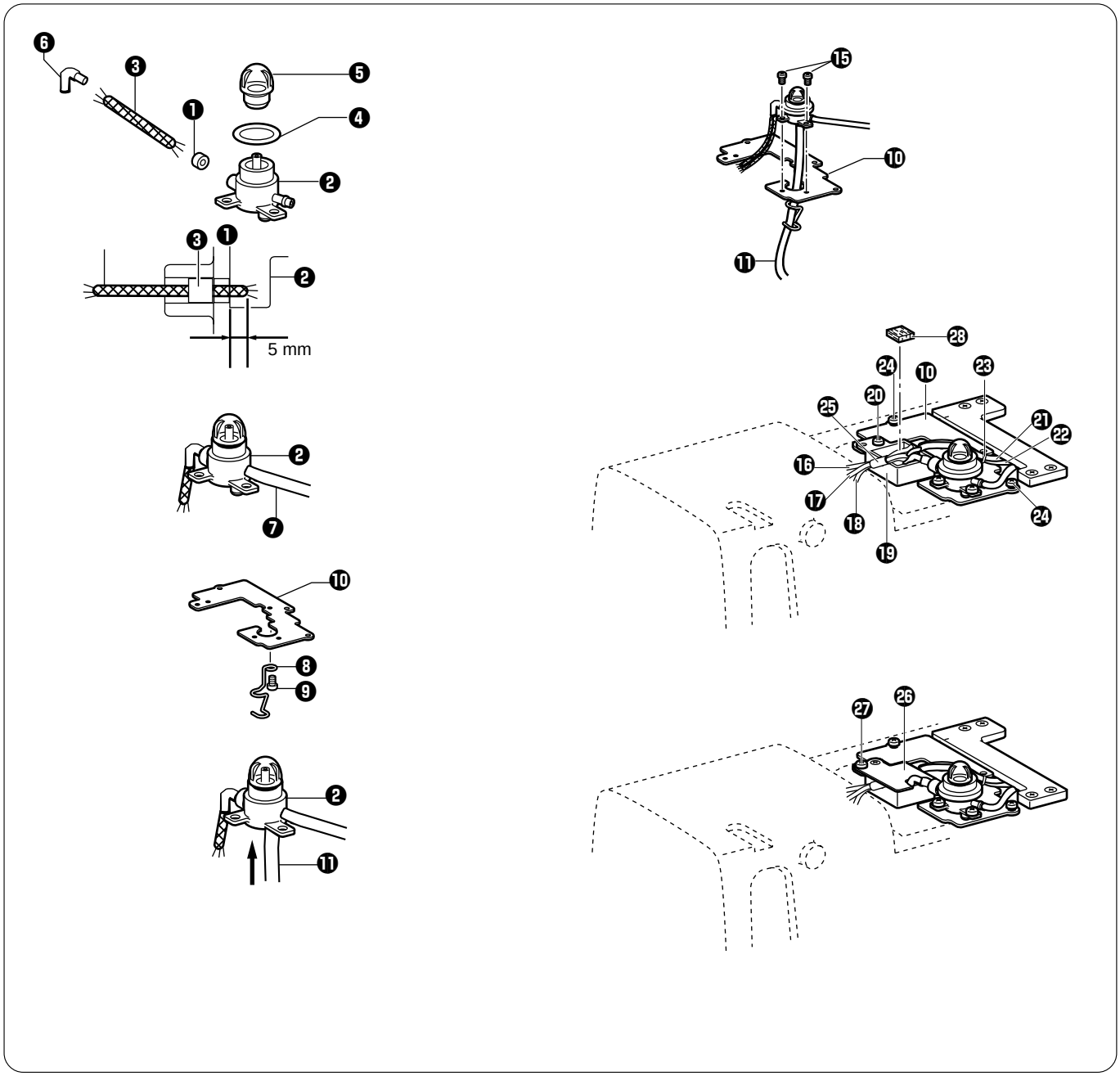
Pass the oil tube ❶ through tube support U ❷ and the tube support ❸, and secure it with the screw ❹.
Install the felt support ❺ to the motor bracket ❿ with the screw ❾ so that the felt ❻ of the felt support ❺ is gently touching the felt ❽ of the zigzag connecting rod ❼.
Pass the oil tube ❶ around the outside of tube support U ❷ as shown in the illustration so that it does not touch the solenoid stopper ⓫, and then pass it in between the cutter solenoid ⓬ and the arm.

Oil tubes



Insert the felt ❶ into the arm, and then insert it into the hole in the thread take-up lever cover ❷.
Install the felt holder ❸ with the screw ❹, and then secure the felt ❶ and the oil tube ❺.
Install the oil tube ❻ that is connected between the oil terminal and the oil outlet with the cord holder ❼, screw ❽ and washer ❾.
Clamp the oil tube ❺ under the cord holder ❼.
Install the tube support ❿ with the screw ⓫, and then secure the oil tube ❺ and the oil tube ❻ that is connected between the oil terminal and the oil outlet so that they do not touch the pulse motor (for presser lifter).
Install the oil tube ⓬ that is connected to the oil terminal and the plunger pump with tube support M ⓭ and the screw ⓮, pass it through the arm hole ⓯, and then secure it to the arm with the fastening band ⓰. At this time, bind the oil tube carefully so as not to break it.

Oil terminal mechanism



Pass the wick ❸ through the collar ❶, and then insert it into the oil terminal ❷ so that it protrudes by approximately 5 mm. Insert the packing ❹ into the oil terminal ❷, and then install the oil cap ❺. Pass the wick ❸ through oil pipe B ❻, and then install it to the oil terminal ❷.

Push the oil tube ❼ that is connected between the oil terminal and the plunger pump into the oil terminal ❷.

Push the oil tube ⓫ that is connected between the oil terminal and the oil outlet into the oil terminal ❷.

Install the tube support ❽ to the wick base support ⓾ with the screw ❾.

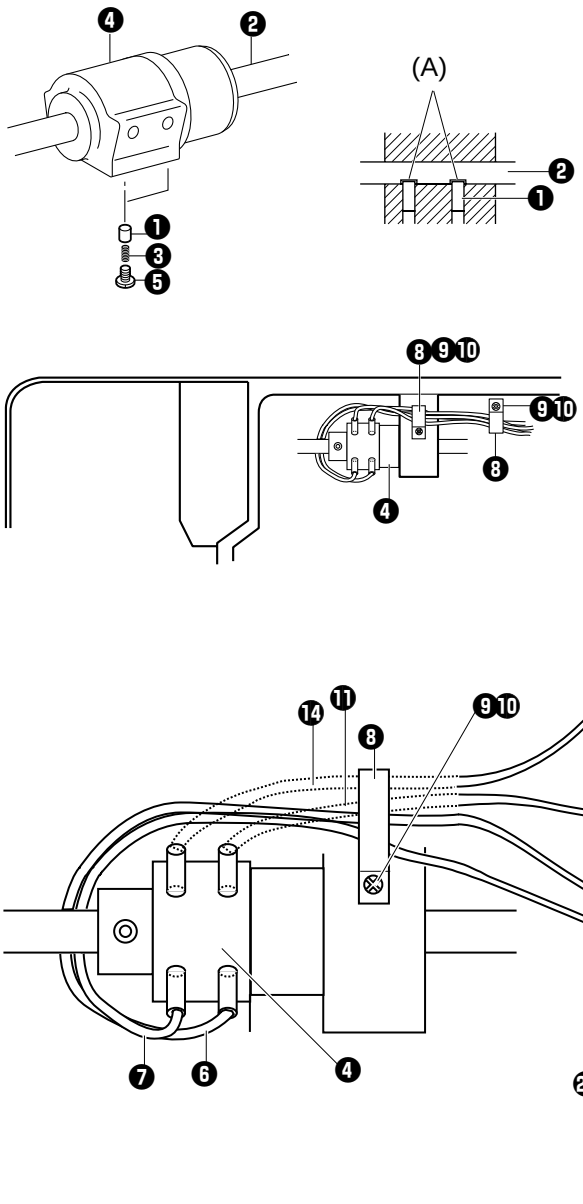
Attach the oil tube ⓫ to the tube support ❽, and then install the oil terminal ❷ to the wick base support ⓾ with the two screws ⓯.

Pass the wick ⓰ from the needle bar bracket, the wick ⓱ from the bush and the wick ⓲ from the support shaft through the oil tube ㉕, and then install felt base A ⓳ to the wick base support ⓾ with the screw ⓴.

Install the oil tube ㉑ for lubricating the bush and the zigzag lever shaft and the oil tube ㉒ for lubricating the zigzag mechanism with the fastening band ㉓, and then install them to the wick base support ⓾.

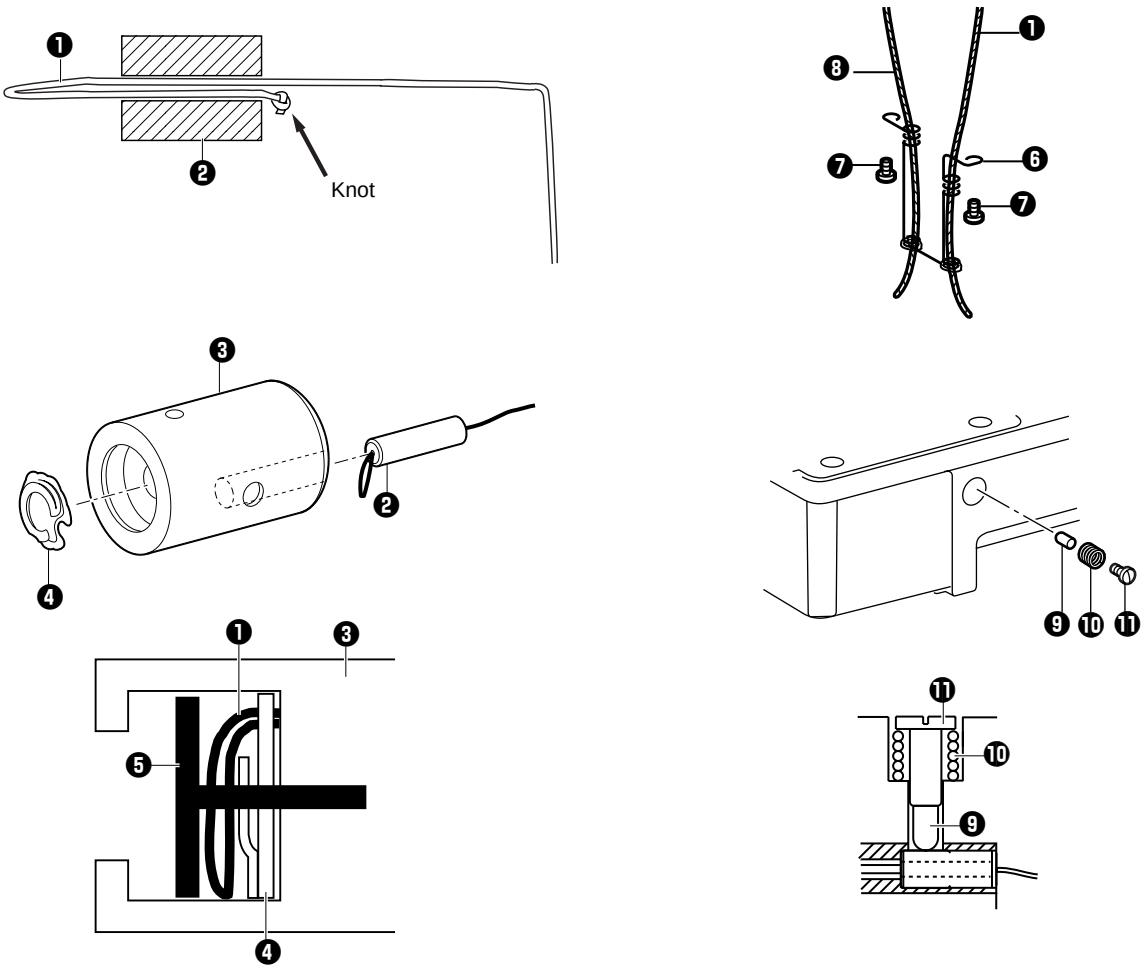
Install felt base A ⓳ with the screw ㉔. Insert the felt ㉘, and then install the cap ㉖ with the screw ㉗.

Plunger pump mechanism



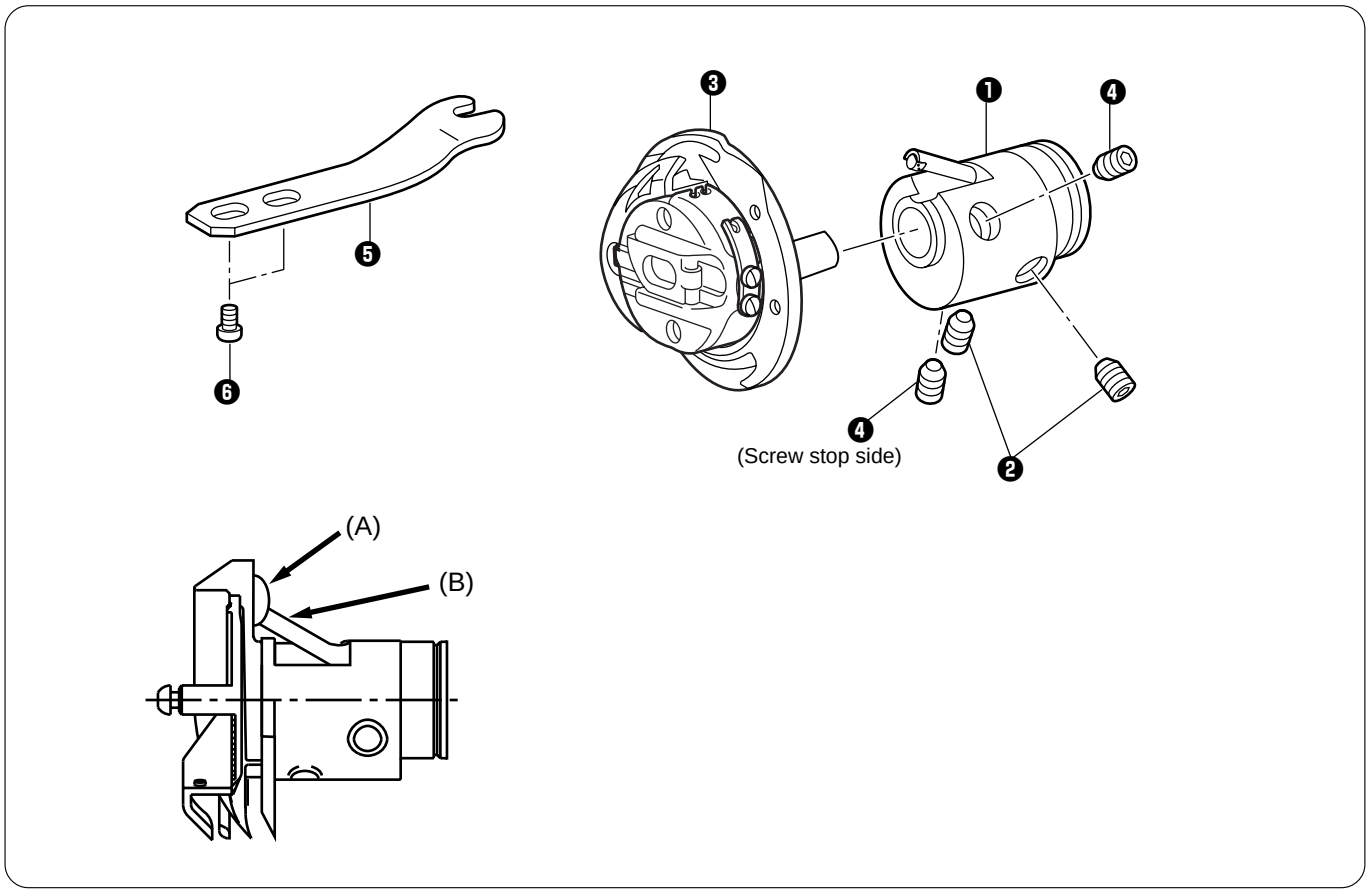
Check that the notches (A) of the plungers ❶ and the lower shaft ❷ are aligned, and then insert the two plungers ❶ and the two compression springs ❸ into the bush ❹ and secure them with the two screws ❺.
Insert the oil tube ❻ into the lubricating hole to the right of the bush ❹. Insert the oil tube ❼ that is connected between the plunger and the filter into the lubricating hole to the left of the bush ❹.
Insert the oil tube ⓫ into the lubricating hole to the right of the bush ❹. Pass the outlet of the oil tube ⓫ through the tube support ⓬. Secure the tube support ⓬ to the bed with the screw ⓭. Insert the oil tube ⓮ that is connected between the oil terminal and the plunger pump through the lubricating hole to the left of the bush ❹.
Pass the oil tube ⓰ that is connected between the oil terminal and the oil outlet through tube support D ⓯. Secure tube support D ⓯ to the bed with the screw ⓱.
Secure the four tubes that are coming out from the bush ❹ to the bed in two places as shown in the illustration with the cord holder ❽, screw ❾ and plain washer ❿.
Install the pump filter ⓲ to the oil filter bracket ㉑ with the two springs ⓳ and the two screws ⓴.
Insert the oil tube oil tube ❼ that is connected between the plunger and the filter through the oil filter bracket ㉑. Install the oil filter bracket ㉑ to the bed with the three screws ㉒.

Rotary hook lubrication mechanism



Pass the wick ❶ through the collar ❷ as shown in the illustration.
Place the collar ❷ onto the bush ❸ as far as the base of the hollow. Insert the spring ❹ into the bush ❸, and then insert the wick ❶ as shown in the illustration.
Push the end of the felt ❺ into the hole in the bush ❸ and stop it from turning.
Install the felt support ❻ to the bed with the two screws ❼.
Pass the wick ❶ through the felt support ❻ and tie a knot in it. Pass the wick ❽ through the felt support ❻ and then tie a knot in it.
Insert the rubber presser ❾ into the bed, and then secure it with the spring ❿ and the screw ⓫.
As a guide to the rotary hook lubrication amount, fully tighten the screw ⓫, and then loosen it by about two turns.
To check and adjust the lubrication amount, refer to "4-22. Adjusting the rotary hook lubrication".

3-15. Rotary hook mechanism



Install the rotary hook joint assembly ❶ to the lower shaft, and then secure it by tightening the set screw ❷. Tighten the set screw ❹ so that the lubrication port (A) of the hook ❸ and the lubrication port (B) of the rotary hook joint assembly ❶ are aligned. Then adjust the needle clearance and timing. Install the rotary hook holder ❺ with the two screws ❻.

4. ADJUSTMENT

Notes on making adjustments

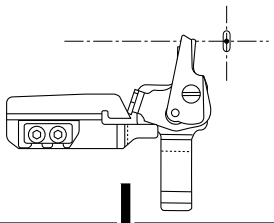
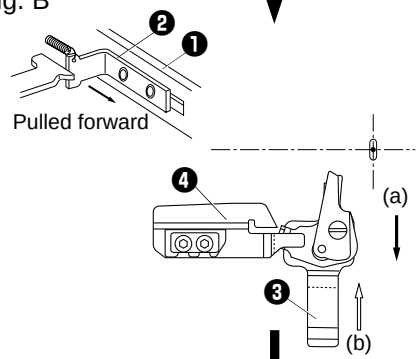
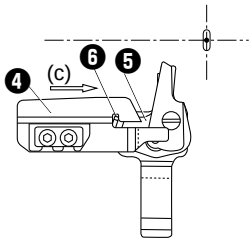
[When turning on the power to make adjustments]

1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot before carrying out adjustments.
   "Adj" will appear in the numeric display and the machine will not operate even if the treadle is pressed.
   * Some items are adjusted without the RESET key being pressed. Carry out the adjustment by following the explanations given.

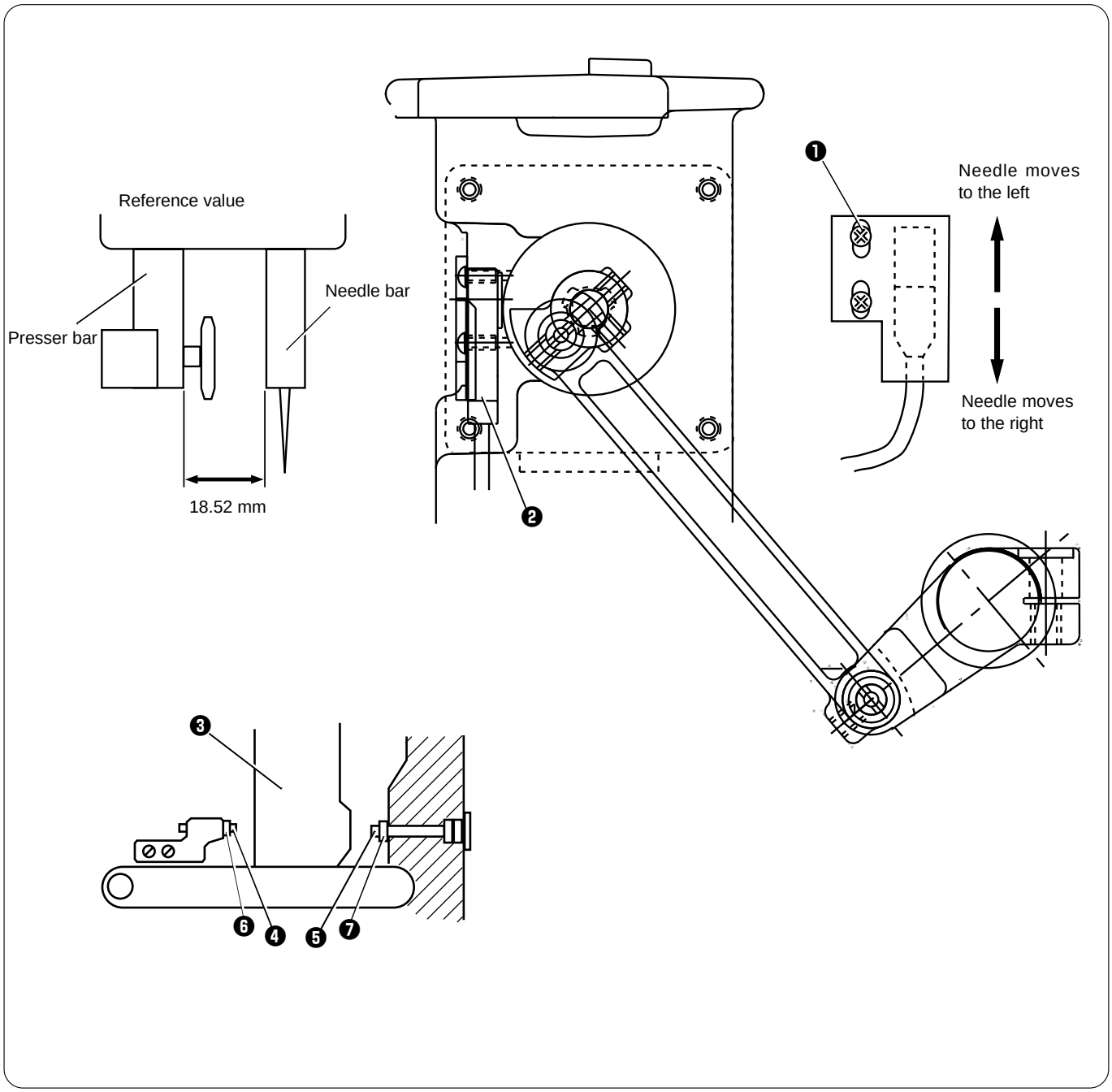
[When turning off the power to make adjustments]

* Do not force any of the parts to move, as doing so may result in damage to the parts.

1. Be sure to turn the machine pulley to raise the needle bar to its highest position before making adjustments.
   * If this is not done, the pulley position (the direction of rotation of the rotary hook) may cause the lower thread trimmer mechanism to touch the rotary hook when the lower thread trimmer mechanism operates.
2. When turning the machine pulley, do it at a position where the thread trimmer mechanism will not operate (the position where the presser foot pulse motor is at the home position).
   * If the machine pulley is turned at a position where the thread trimmer mechanism operates, the needle may touch the lower thread trimmer mechanism (lower thread retainer and lower thread trimmer knife).
   * If the machine pulley is turned at a position where the thread trimmer mechanism operates, the rotary hook and the lower thread trimmer mechanism may touch.
3. When moving the feed mechanism, do it at a position where the thread trimmer mechanism will not operate (the position where the presser foot pulse motor is at the home position).
   * If this is not done, the lower thread retainer and the feed guide shaft may alternately push against the lower thread clamp and the opening plate, and damage may result.
4. When pushing the knife down by hand, be careful not to let it touch the upper thread scissors.
5. Do not move the feed mechanism while the stop plate of the upper thread trimmer lever is pulled forward and the upper thread scissors are open (the upper thread trimmer lever is pushed to the left).
   Always return the stop plate to its original position before moving the feed mechanism or returning it to the home position.

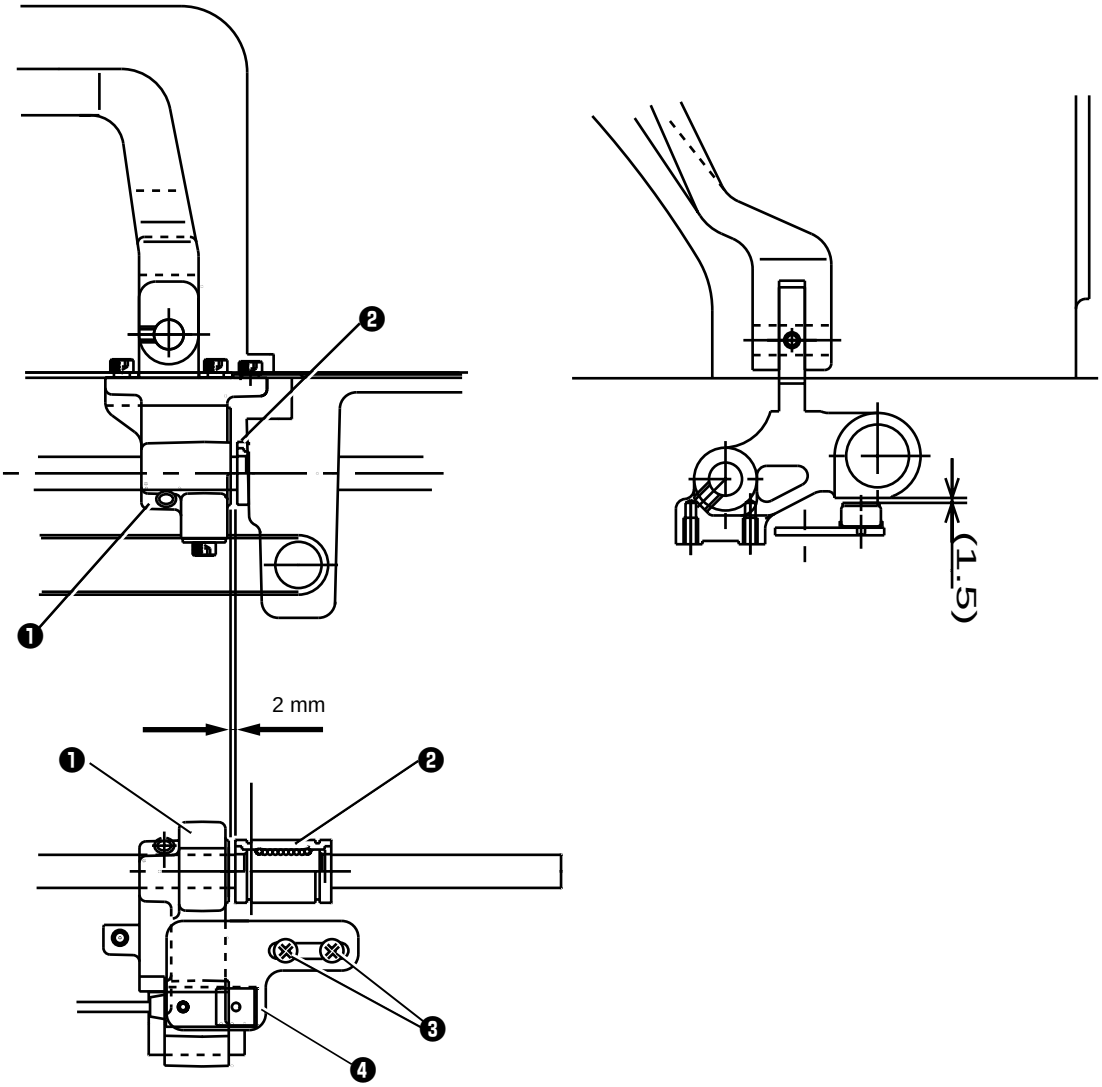
Fig. A 	Presser foot lifter pulse motor and feed pulse motor home position (sewing start position)
Fig. B 	When the stop plate ❷ of the upper thread trimmer lever ❶ is pulled forward from the position in diagram (A), the upper thread trimmer assembly ❸ moves in the direction of the arrow (a) and goes below the projection of the opening cam ❹.
Fig. C 	Them when the feed mechanism is operated (arrow (c)), the scissors assembly ❸ is forced to go behind the opening cam ❹. Depending on the case, the rising section ❻ of scissors M ❺ goes into the hollow shown in the diagram and the feed mechanism cannot then operate. At this time, when feed mechanism home positioning is carried out, the feed pulse motor goes out of step. * Operate the feed mechanism when the condition is as shown in diagram A. If it is pushed in the direction of arrow (b) at the condition shown in diagram B, the condition will change to that shown in diagram A.

4-1. Adjusting the needle zigzag home position sensor position



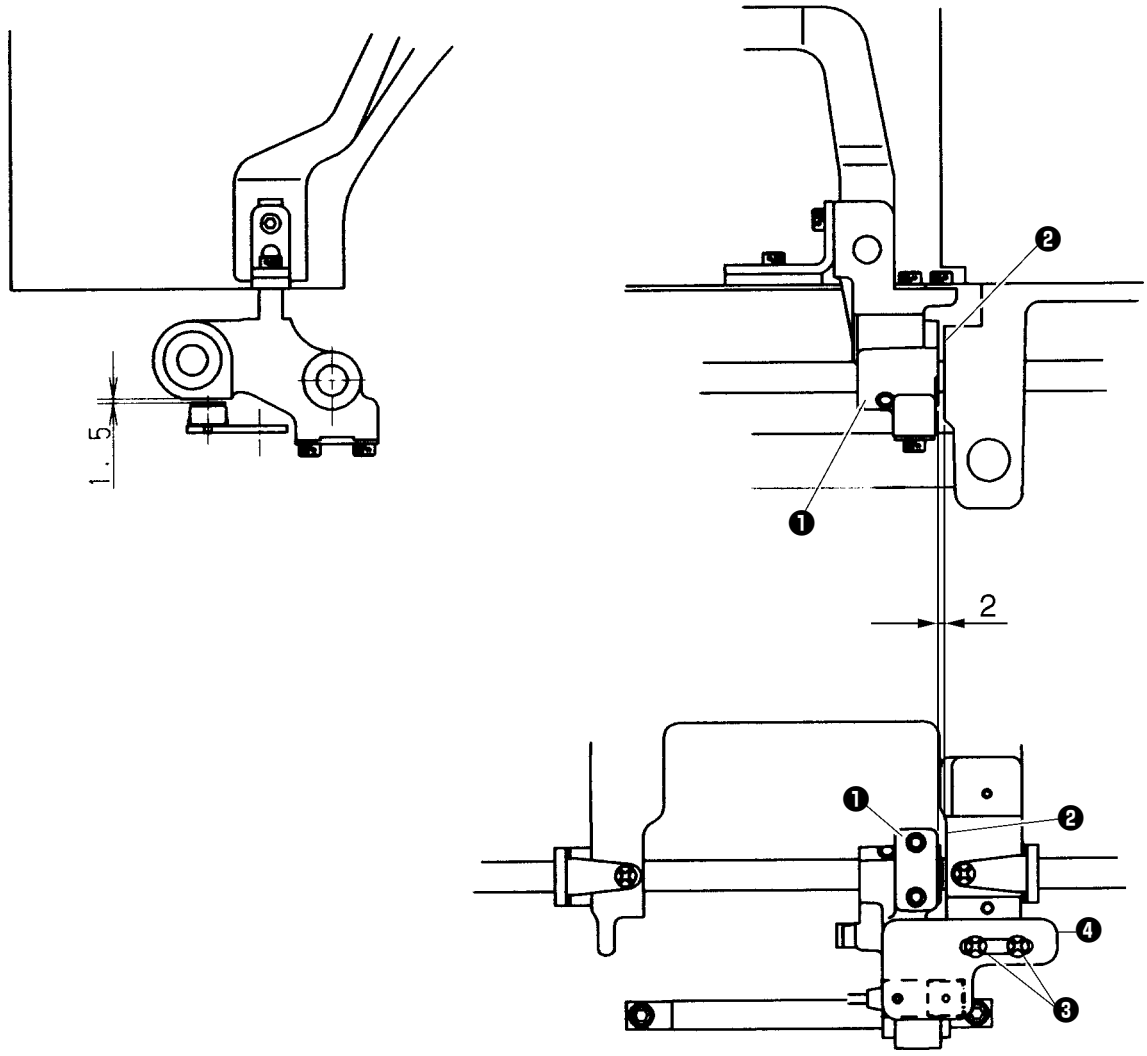
1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. If the needle is in the center of the needle plate hole, the following adjustment is not necessary. If the needle is not in the center of the needle plate hole, turn off the power.
3. Loosen the screw ❶, and then adjust the vertical position of the needle zigzag sensor assembly ❷.
   * The adjustment required is only slight, so move the needle zigzag sensor assembly ❷ a little bit at a time.
4. Repeat the procedure from step 1.
   * After adjusting, check that the needle bar bracket ❸ and the stopper screws ❹ and ❺ are not touching when in test feed mode. If the are touching, adjust the stopper screws ❹ and ❺.
     If the needle bar is at its furthest zigzag position, place the stopper screws ❹ and ❺ against the needle bar bracket ❸, and then turn then back about 1/4 of a turn. Then tighten the nuts ❻ and ❼.

4-2. Adjusting the feed home position sensor position



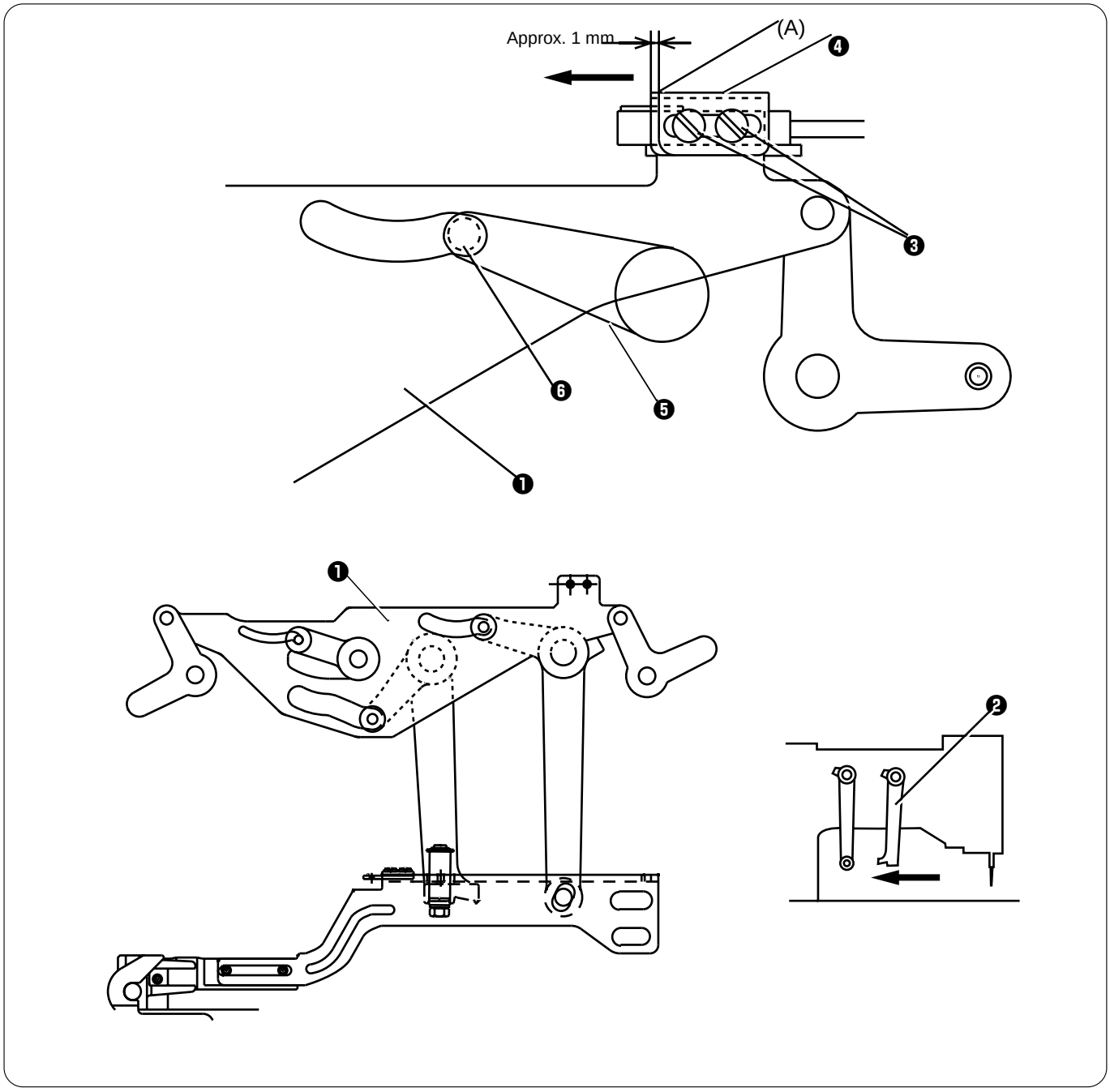
1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. If the clearance between the feed arm support ❶ and the linear bushing ❷ is 2 mm, the following adjustment is not necessary. If the clearance is not 2 mm, turn off the power.
3. Loosen the screw ❸ and adjust the position of the feed sensor support plate ❹.
4. Repeat the procedure from step 1.

[-5 specifications (long-hole specifications)]



1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. If the clearance between the feed arm support ❶ and the bed processed surface ❷ is 2 mm, the following adjustment is not necessary. If the clearance is not 2 mm, turn off the power.
3. Loosen the screw ❸ and adjust the position of the feed sensor support plate ❹.
4. Repeat the procedure from step 1.

4-3. Adjusting the presser foot home position sensor position



1. Turn on the power.

* Do not set the sewing machine to the home position.

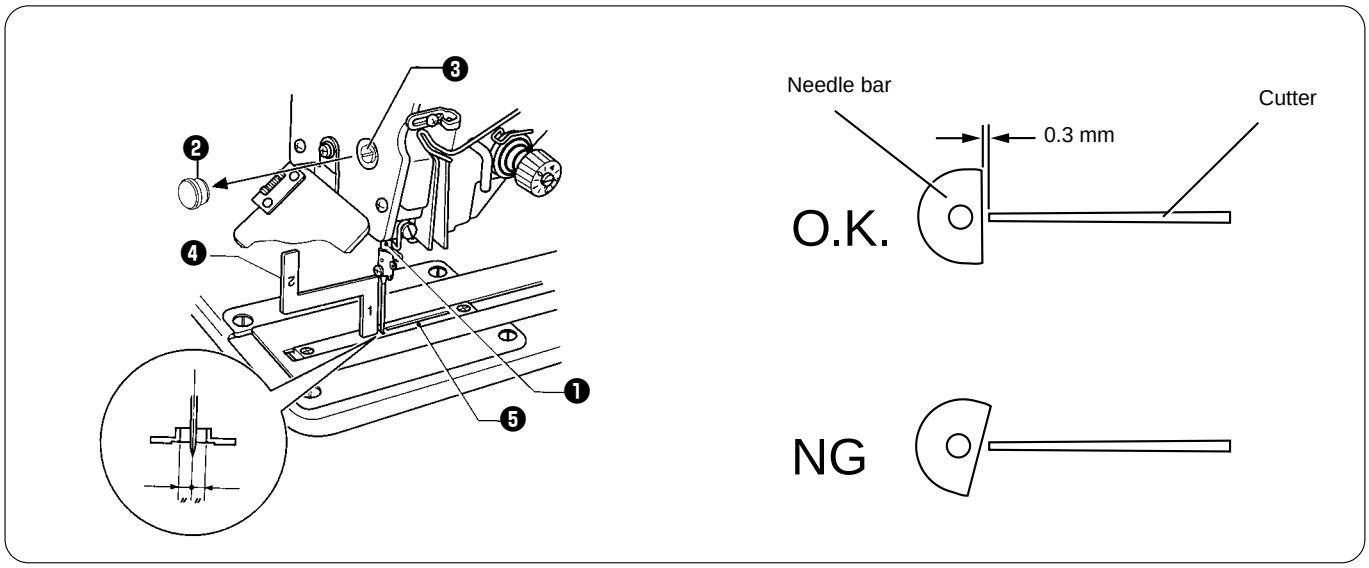
2. Move the trimmer driving arm ❷ in the direction of the arrow to move the upper thread trimmer driving link ❶ until it is stopped by the face plate.
3. Loosen the screw ❸, and then move the dog ❹ by approximately 1 mm in the direction of the arrow past position (A) where the work clamp sensor turns on (the work clamp sensor LED lights). (This is the provisional position for the work clamp home position sensor. The final position is determined when making the adjustment in "4-13-8. Adjusting the upper thread scissors opening timing".)
4. Set the sewing machine to the home position, and then press the RESET key. Check that there is no impact noise and that the motor does not go out of step when the presser foot is lowered.

* If the adjustment is not correct, the presser foot may touch the upper thread trimmer driving link ❶ and the roller ❻ of the thread trimmer drive lever ❺, and this may cause the motor to go out of step.

* Make this adjustment before carrying out "4-13. Adjusting the upper thread trimming".

* After making this adjustment, check the tension release of the tack tension control and the upper thread trimming, and adjust if necessary by referring to the respective adjustment procedures.

4-4. Adjusting the needle bar height

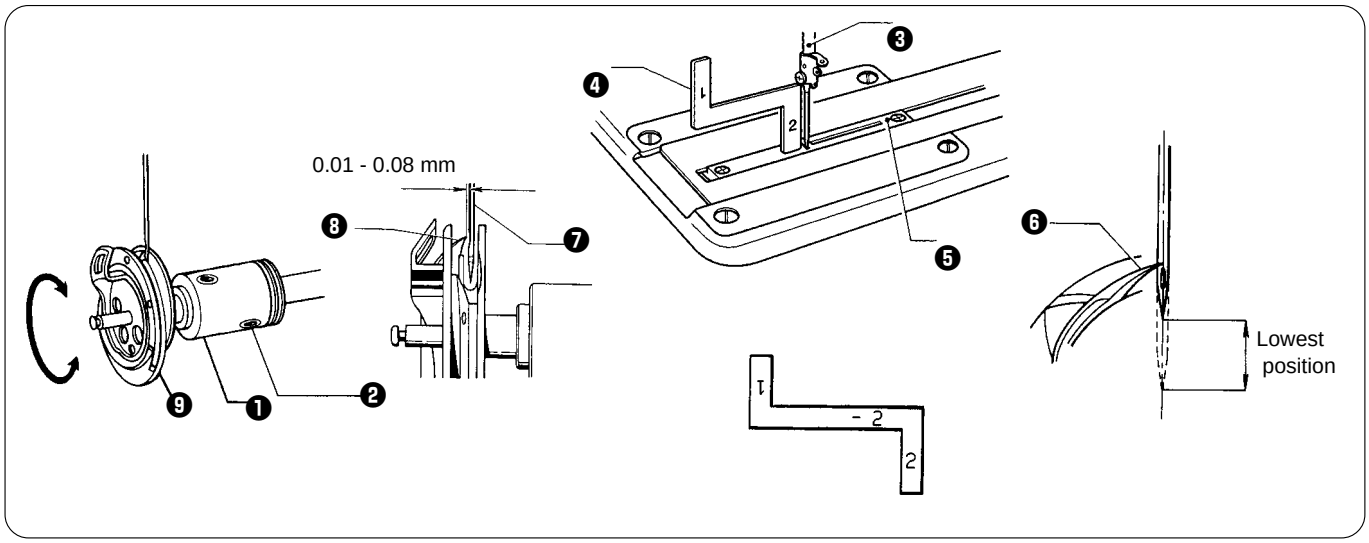


Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Move the needle bar ❶ to its lowest position. (Check that the needle is in the center of the needle hole. If adjustment is necessary, make the adjustment while referring to "4-1. Adjusting the needle zigzag home position sensor position".)
2. Remove the rubber cap ❷ from the face plate, and then loosen the set screw ❸ of the needle bar clamp.
3. Insert the “1” part of the gauge ❹ between the needle plate ❺ and the lower edge of the needle bar ❶, and move the needle bar ❶ so that it touches the gauge ❹.
   * Different gauges are used for each of the three sub-classes -2, -3 and -5, so make sure that the gauge being used matches the specifications and application for the sewing machine being adjusted.
4. Tighten the set screw ❸.
5. Install the rubber cap ❷.

* Check that the knife flank of the needle bar is at a right angle to the knife. If the installation positions are not correct, the needle bar and knife may touch when the needle zigzags, which may result in noise or cause the needle to break.

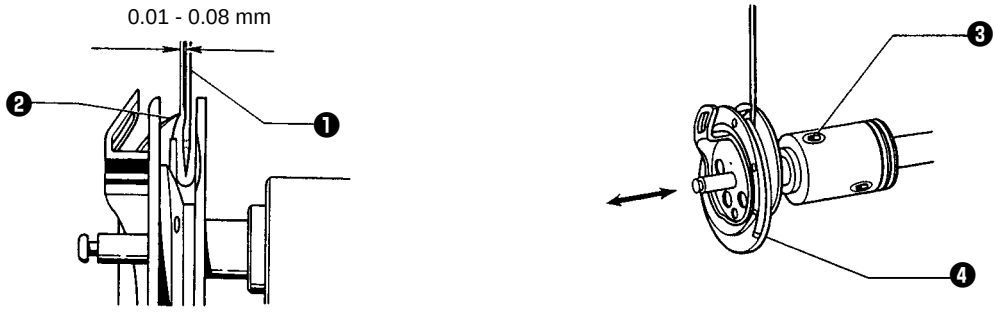
4-5. Adjusting the needle and rotary hook timing



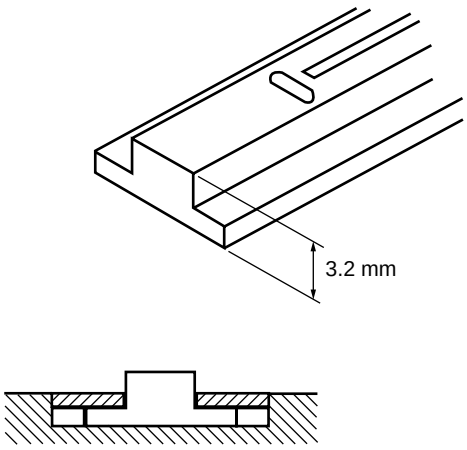
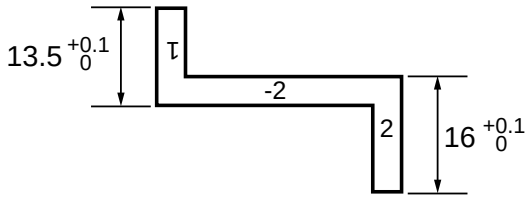
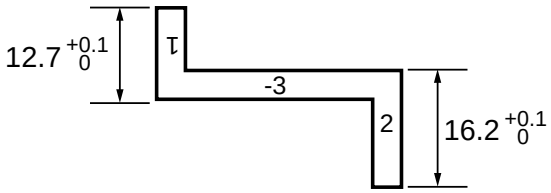
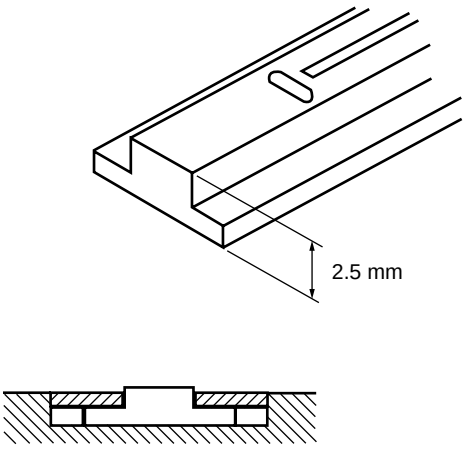
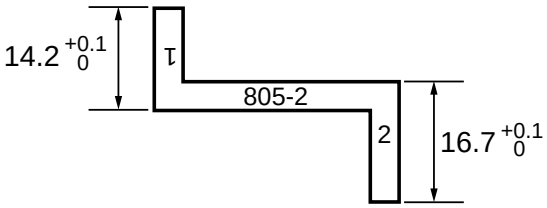
Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Loosen the two set screws ❷ of the rotary hook joint ❶.
2. Turn the machine pulley in the regular direction of rotation (toward the front) so that the needle bar ❸ just begins to rise from its lowest position.
3. Insert the “2” part of the gauge ❹ between the needle plate ❺ and the lower edge of the needle bar ❸, and then align the rotary hook point ❻ with the center of the needle when the needle bar contacts the gauge.
   * Different gauges are used for each of the three sub-classes -2, -3 and -5, so make sure that the gauge being used matches the specifications and application for the sewing machine being adjusted.

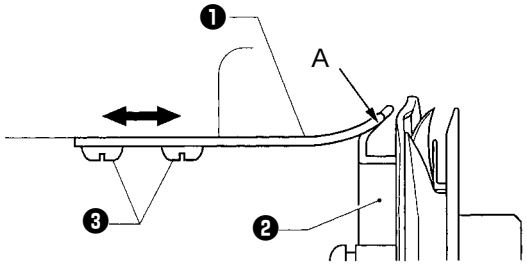
Adjusting the clearance between needle and hook point



Loosen the screws ❸ and move the rotary hook ❹ forward or back until there is a clearance of 0.01 to 0.08 mm between the needle ❶ and the hook point ❷.

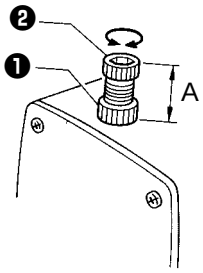
Needle plate thickness	Application	Gauge
	Clothing (-2) Knitted wear	S13595-001 Gauge 815-2 
	Knitted wear (-3)	S13596-001 Gauge 815-3 
	Long-hole specifications (-5) Thin knitted wear	S13597-001 Gauge 805-2 

4-6. Adjusting the inner rotary hook and rotary hook holder overlap



1. Loosen the screw ❸ to adjust so that the tip of the rotary hook holder ❶ does not protrude past edge A of the inner rotary hook ❷.

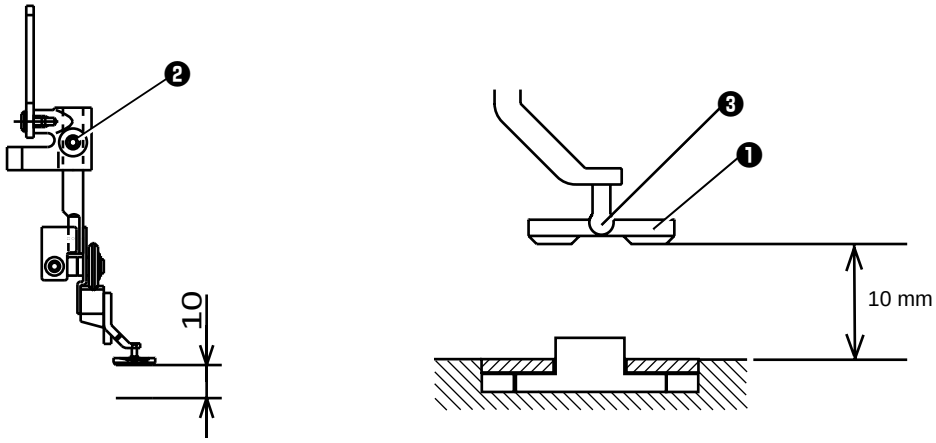
4-7. Adjusting the presser foot pressure



1. The standard distance A is 30 mm (approximately 30 N).
2. Loosen the nut ❶ and turn the pressure adjusting screw ❷ to adjust the presser foot pressure.

* When the rpessure ajusting screw ❷ is tightened as far as it will go, the presser foot pressure will be about 70 N.

4-8. Adjusting the work clamp lift amount

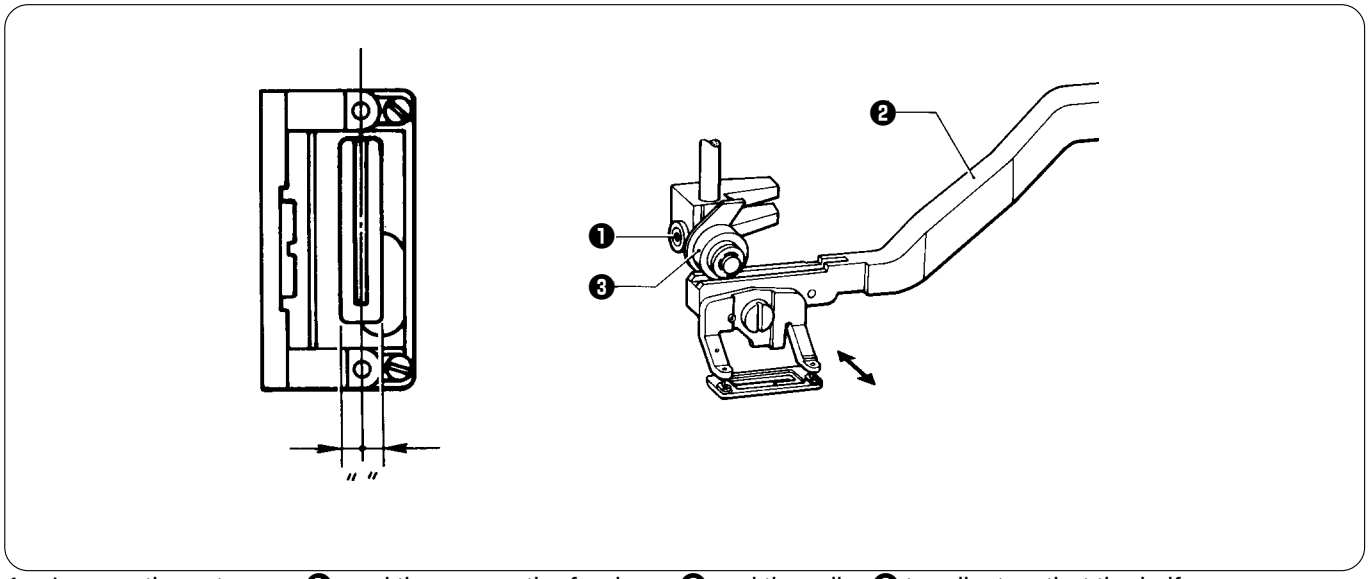


Turn on the power and set the sewing machine to the home position before making this adjustment.

1. Check that memory switch No. 05 (presser foot height at neutral position) is set to 10 mm. (If it is not set to 10 mm, set it to 10 mm.)
2. Place a 10 mm gauge under the work clamp ❶ and then loosen the screw ❷ to make the adjustment.

* Adjust the lift amount (including the play in the work clamp ❶ and the pin ❸ to 10 mm. If it is set to more than 10 mm, the work clamp will start lifting before lower thread trimming is complete, which may result in thread trimming errors. Furthermore, it may also cause the presser foot lifter pulse motor to go out of step.

4-9. Adjusting the work clamp lateral position

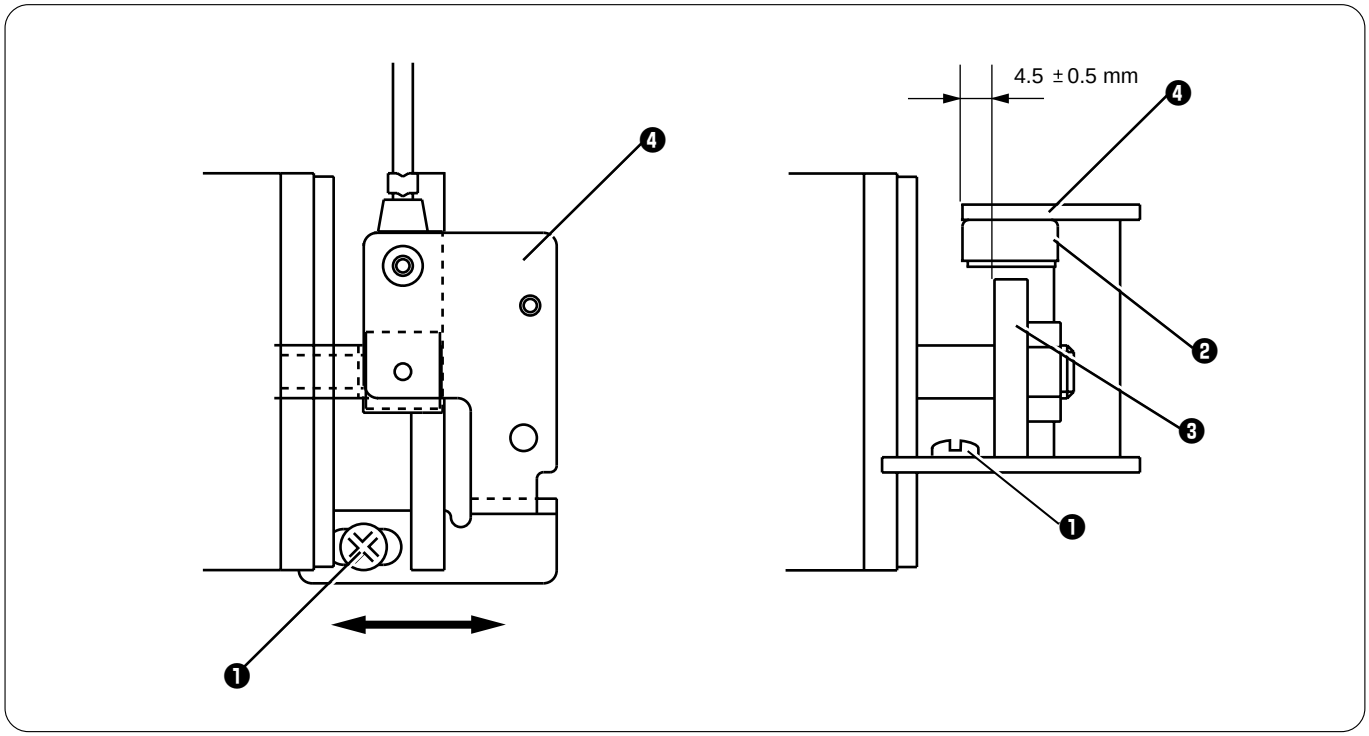


1. Loosen the set screw ❶, and then move the feed arm ❷ and the roller ❸ to adjust so that the knife groove comes to the center of the work clamp window.

* After adjusting, operate the presser foot lifter pedal and check that the work clamp moves up and own smoothly.

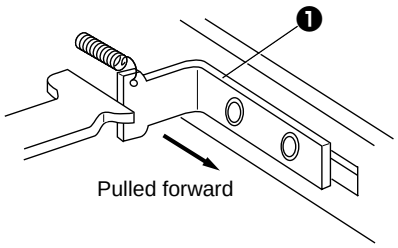
* After adjusting, check the upper thread trimmer mechanism and adjust if necessary.

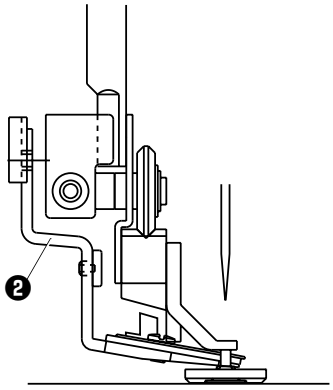
4-10. Adjusting the knife home position sensor position



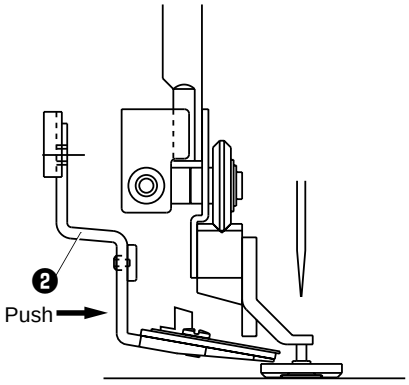
1. Loosen the screw ❶, and then adjust the knife sensor assembly ❹ so that there is a clearance of 4.5 ± 0.5 mm between the side of the sensor ❷ and the edge of the solenoid stopper ❸.

4-11. Adjusting the knife installation position

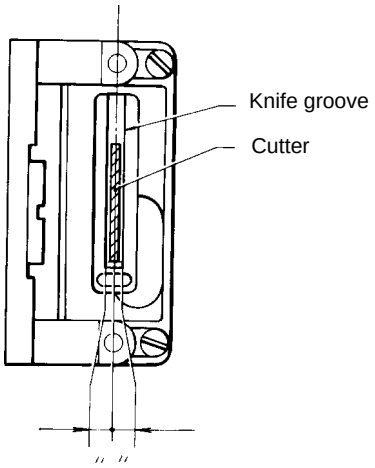


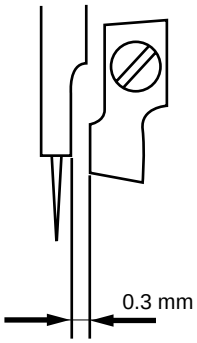


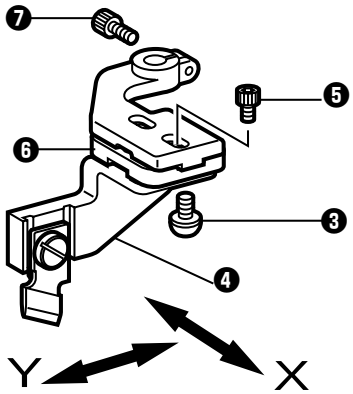
(Fig. A)

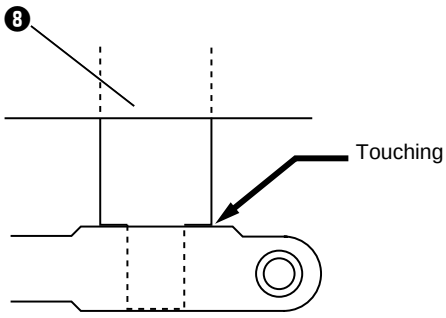


(Fig. B)









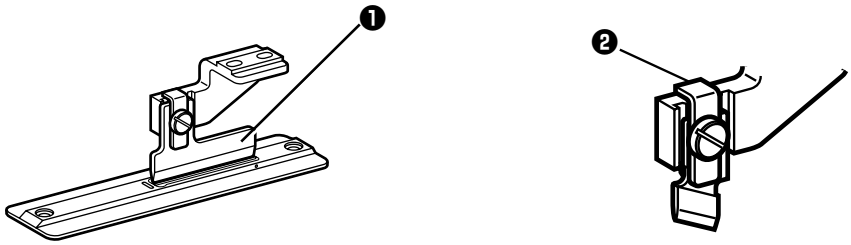
Adjust so that the upper thread trimmer knife and the cutter do not touch when the cutter is pushed down by hand. If the upper thread trimmer knife extends below the cutter, pull the stop plate ❶ forward and move the upper thread trimmer assembly ❷ to the left. (Fig. A → Fig. B)

1. Loosen the screw ❸, and adjust the cutter Y direction using cutter holder DL ❹ so that the clearance between the needle bar and the cutter is 0.3 mm. (When replacing the cutter, be careful not to allow the cutter to touch the needle bar because of any play in the cutter installation position.)
   In addition, loosen the screw ❺ and adjust the cutter X direction using cutter holder M ❻ so that the cutter goes into the center of the cutter groove. Loosen the screw ❼ and move the cutter holder to adjust the direction of rotation.

* When the screw ❼ has been loosened, check that the edge of the cutter holder is touching the stepped section of the cutter driving shaft ❽, and then tighten the screw ❼.

* After adjusting, push the upper thread trimmer assembly ❷ back to its original position (Fig. A).

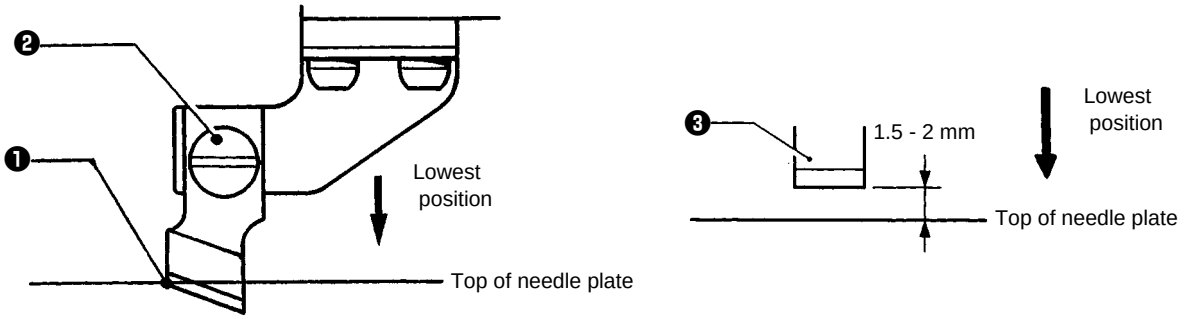
<When using the special needle plate (needle plate -RB)>



The special needle plate has a narrow cutter groove of 0.3—0.4 mm, so use the accessory positioning plate ❶ to adjust the cutter installation position.
Furthermore, install the cutter holder ❷ to minimize any play in the cutter during cutting.

* If the above adjustment is not made, the cutter may touch the needle plate, and damage to the cutter may result.
* The special needle plate is used to prevent the cutter from getting stuck in the material and not returning.

4-12. Adjusting the cutter installation height

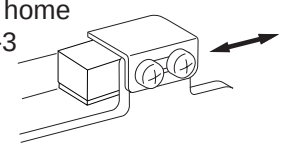
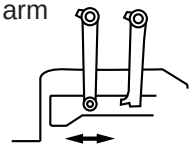
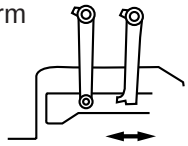
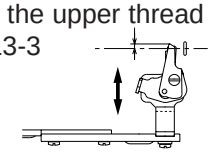
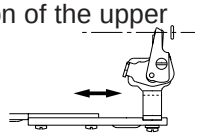
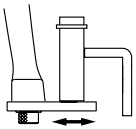
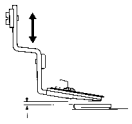
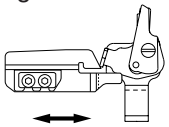
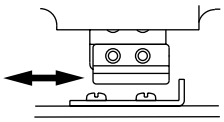


Adjust so that the upper thread trimmer knife and the cutter do not touch when the cutter is pushed down by hand.
If the upper thread trimmer knife extends below the cutter, pull the stop plate ❶ forward and move the upper thread trimmer assembly ❷ to the left. (Fig. A → Fig. B)

1. Install the cutter with the screw ❷ so that the top ❶ of the cutter blade is aligned with the top of the needle plate when the cutter is pressed down by hand to its lowest position.
   For the flat cutter ❸, install with the screw ❷ so that the top ❶ of the cutter blade is 1.5—2 mm above the top of the needle plate.

* After adjusting, push the upper thread trimmer assembly ❷ back to its original position (4-11 Fig. A).

4-13. Adjusting the upper thread trimming

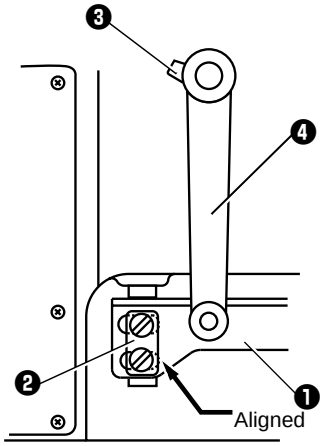
Upper thread trimming adjustment procedure	When adjusting for the first time	When the home position sensor position has been changed	When the longitudinal feed arm position has been changed	When the trimmer driving arm position has been changed	When the lateral position of the upper thread scissors has been changed	When the longitudinal position of the upper thread scissors has been changed	When the cutting depth of the upper thread scissors has been changed	When the installation height of the upper thread scissors has been changed	When the gradual opening timing of the upper thread scissors has been changed	When the opening timing of the upper thread scissors has been changed
Adjusting the presser foot home position sensor position 4-3 	(1)	(1)								
Adjusting the longitudinal feed arm assembly position 4-13-1 	(2)	(2)	(1)							
Adjusting the trimmer driving arm assembly position 4-13-2 	(3)	(3)	(2)	(1)						
Adjusting the lateral position of the upper thread scissors at the sewing start 4-13-3 	(4)				(1)					
Adjusting the longitudinal position of the upper thread scissors 4-13-4 	(5)					(1)				
Adjusting the cutting depth of the upper thread scissors 4-13-5 	(6)						(1)			
Adjusting the installation height of the upper thread scissors 4-13-6 	(7)							(1)		
Adjusting the upper thread scissors gradual opening timing 4-13-7 	(8)	(4)	(3)		(2)	(2)			(1)	
Adjusting the upper thread scissors opening timing 4-13-8 	(9)	(5)	(4)		(3)					(1)

The following should be checked before adjusting the upper thread trimming.

Check the presser foot home position sensor position

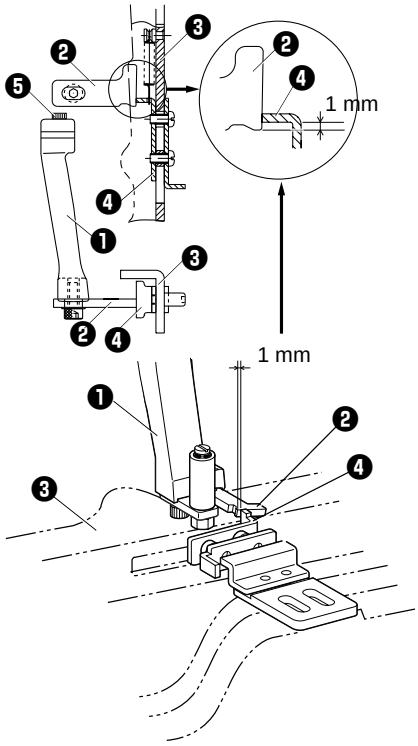
Refer to “4-3. Adjusting the presser foot home position sensor position”.

4-13-1. Adjusting the longitudinal feed arm assembly position



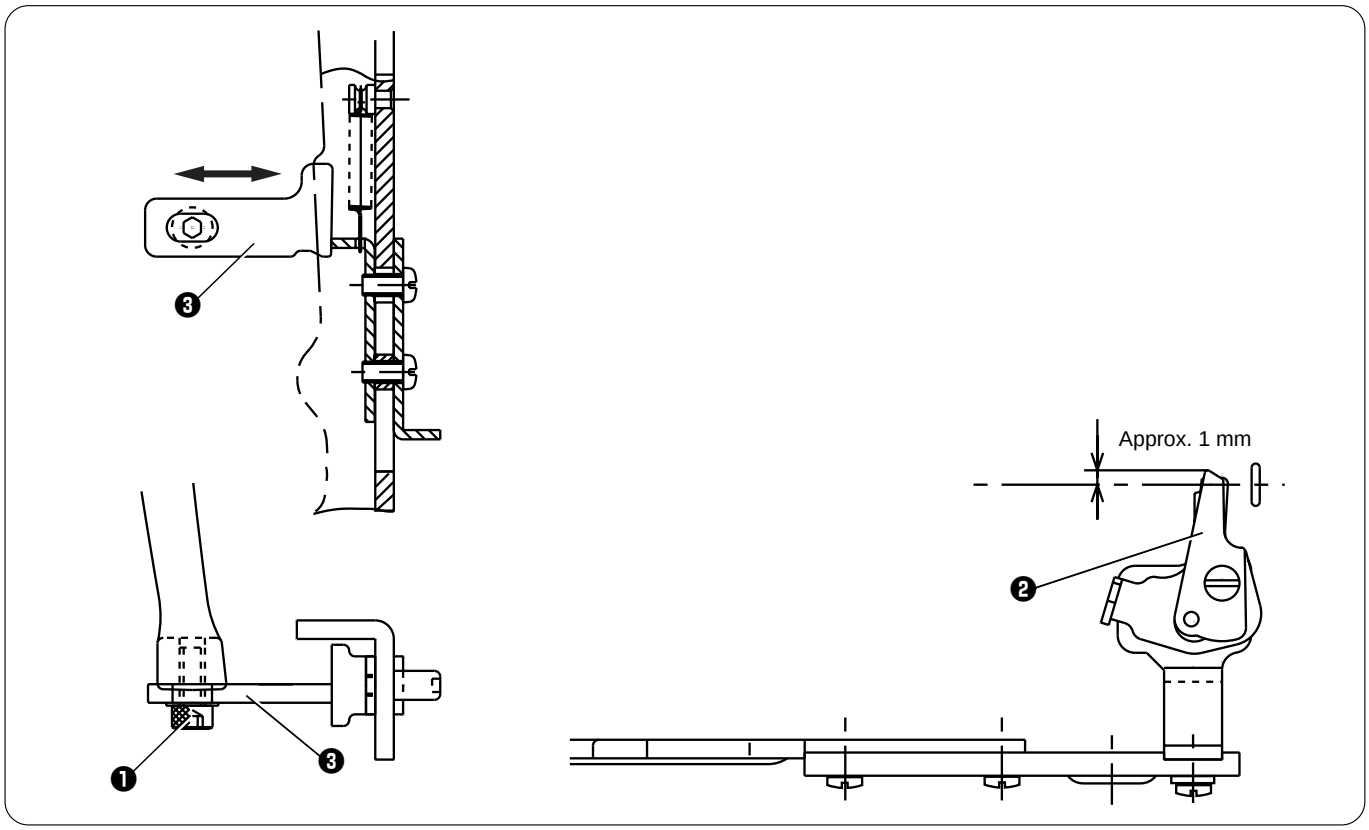
1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. Check that the slot at the bottom of the upper thread trimmer lever set ❶ is aligned with the edge of the washer ❷. If they are not aligned, loosen the bolt ❸ and move the longitudinal feed arm assembly ❹ back and forth to adjust.

4-13-2. Adjusting the trimmer driving arm assembly position



1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. Check that the overlap between the stopper ❷ which prevents the trimmer driving arm assembly ❶ from turning and the stop plate ❹ of the upper thread trimmer lever set ❸ is 1 mm.
   If adjustment is necessary, loosen the bolt ❺ and move the trimmer driving arm assembly ❶ back and forward to adjust.

4-13-3. Adjusting the lateral position of the upper thread scissors at the sewing start

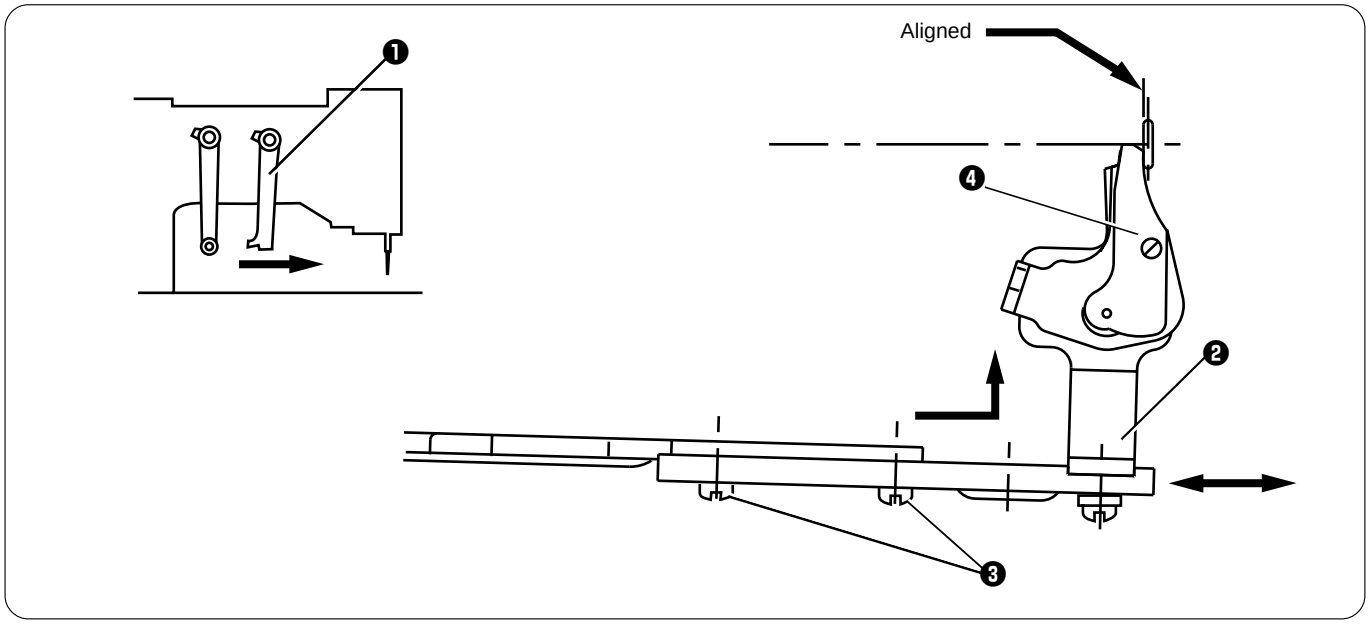


1. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
2. Loosen the screw ❶, and then move the stopper ❸ in and out to adjust so that the edge of the upper thread scissors ❷ protrudes by approximately 1 mm from the center of the cutter.

* If the amount of protrusion of the upper thread scissors ❷ is too great, the scissors may touch the needle when they open.

* When this adjustment is carried out, also carry out the checks and adjustments in "4-13-8. Adjusting the upper thread scissors opening timing".

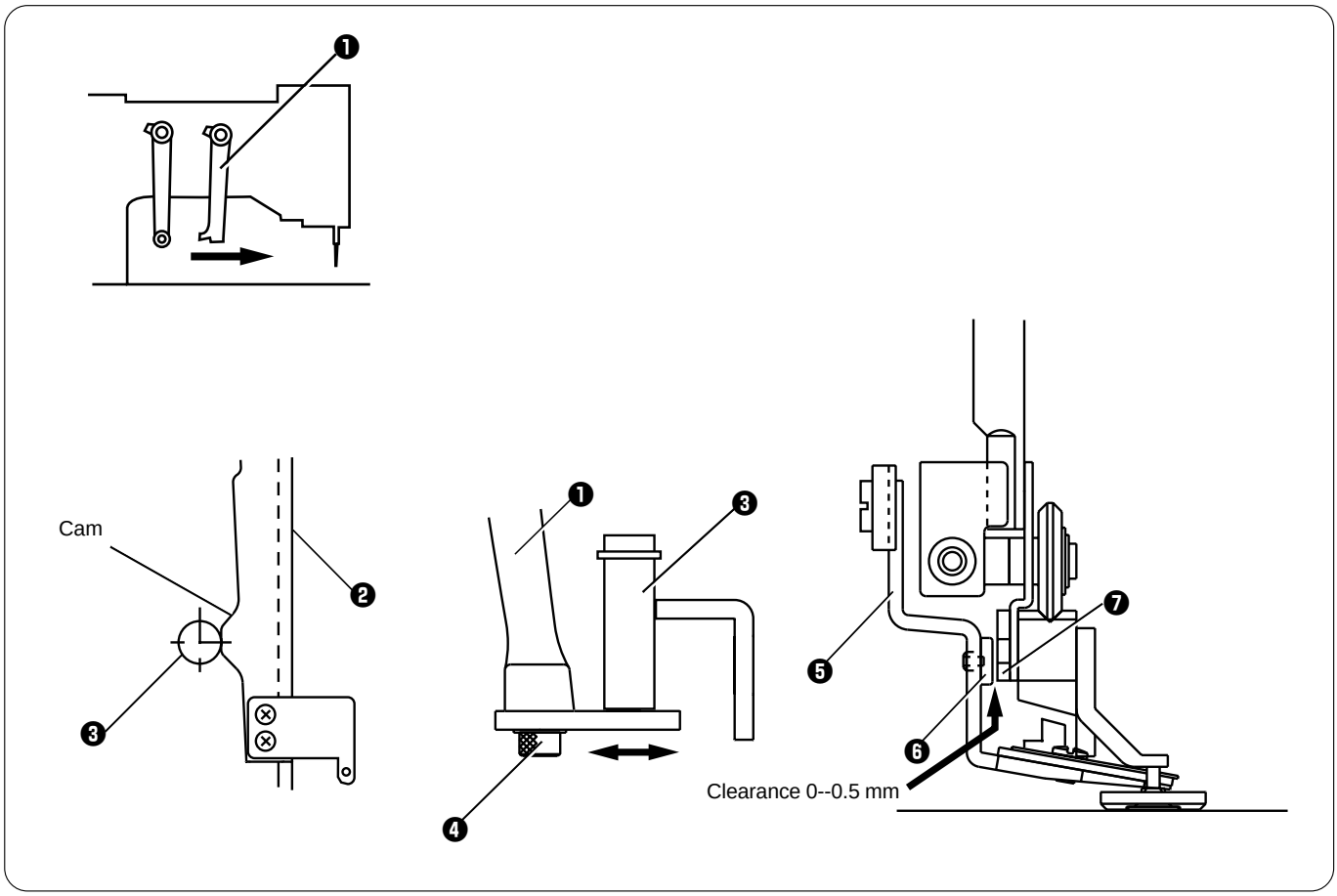
4-13-4. Adjusting the longitudinal position of the upper thread scissors



1. Turn off the power (with the feed mechanism at the home position), and then slowly move the trimmer driving arm ❶ forward until the upper thread trimmer assembly ❷ is at the position shown in the illustration.
2. Loosen the screws ❸, and then move the upper thread trimmer assembly ❷ back and forward to adjust so that the front ridge line of upper thread trimmer U ❹ is aligned with the edge of the needle hole.

* If the above adjustment is not carried out, it may result in thread trimming errors or needle breakages.

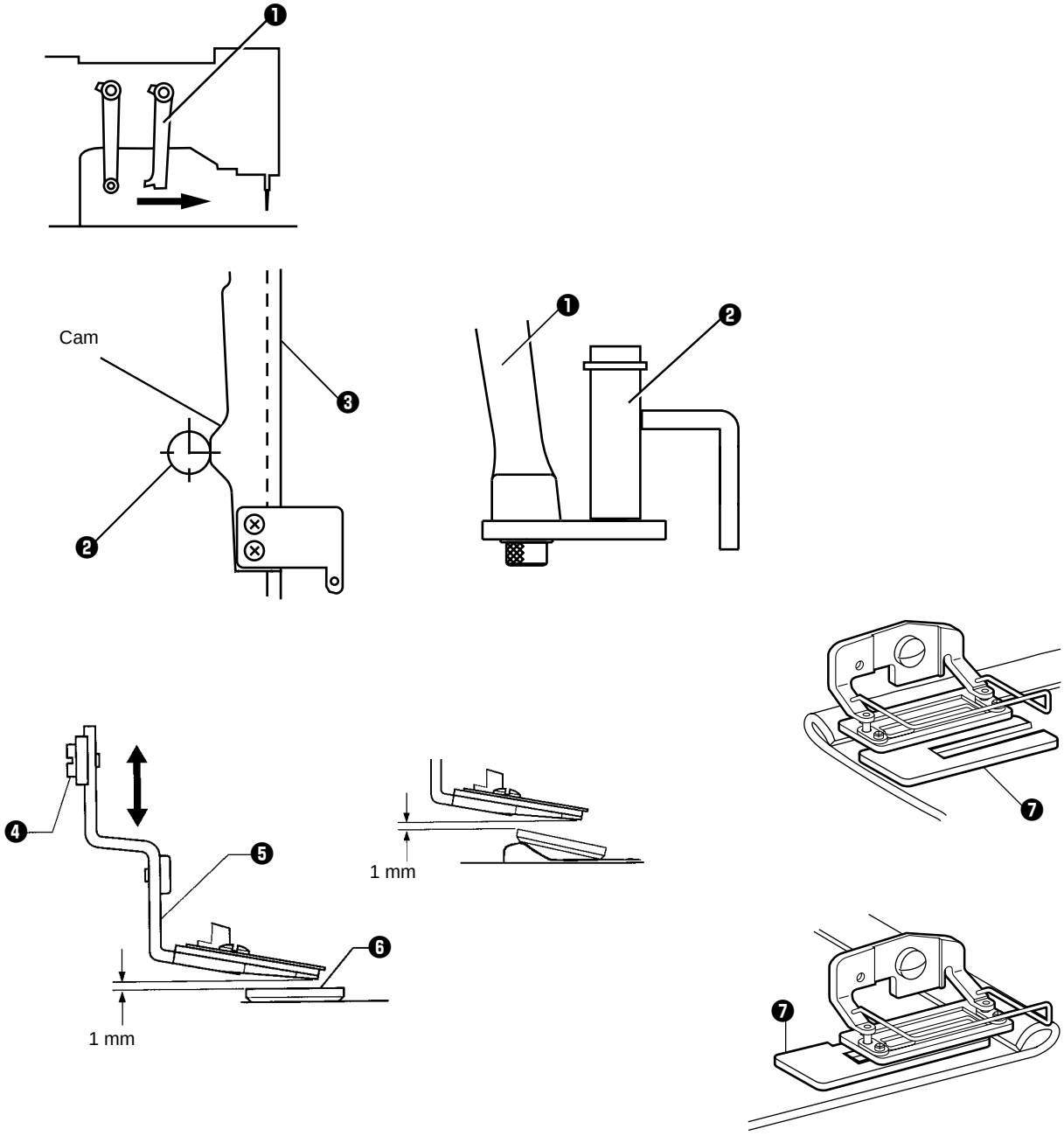
4-13-5. Adjusting the cutting depth of the upper thread scissors



1. Turn off the power (with the feed mechanism at the home position), and then slowly move the trimmer driving arm ❶ forward until the driving arm roller ❸ is at its highest position on the cam of the upper thread trimmer lever ❷.
2. Loosen the screw ❹, and then adjust the driving arm roller ❸ so that the clearance between the stopper ❻ of the upper thread trimmer assembly ❺ and the opening cam bracket ❼ is 0—0.5 mm.

* If the stopper ❻ is adjusted so that it presses too firmly, it may cause the presser foot lifter pulse motor to go out of step.

4-13-6. Adjusting the installation height of the upper thread scissors



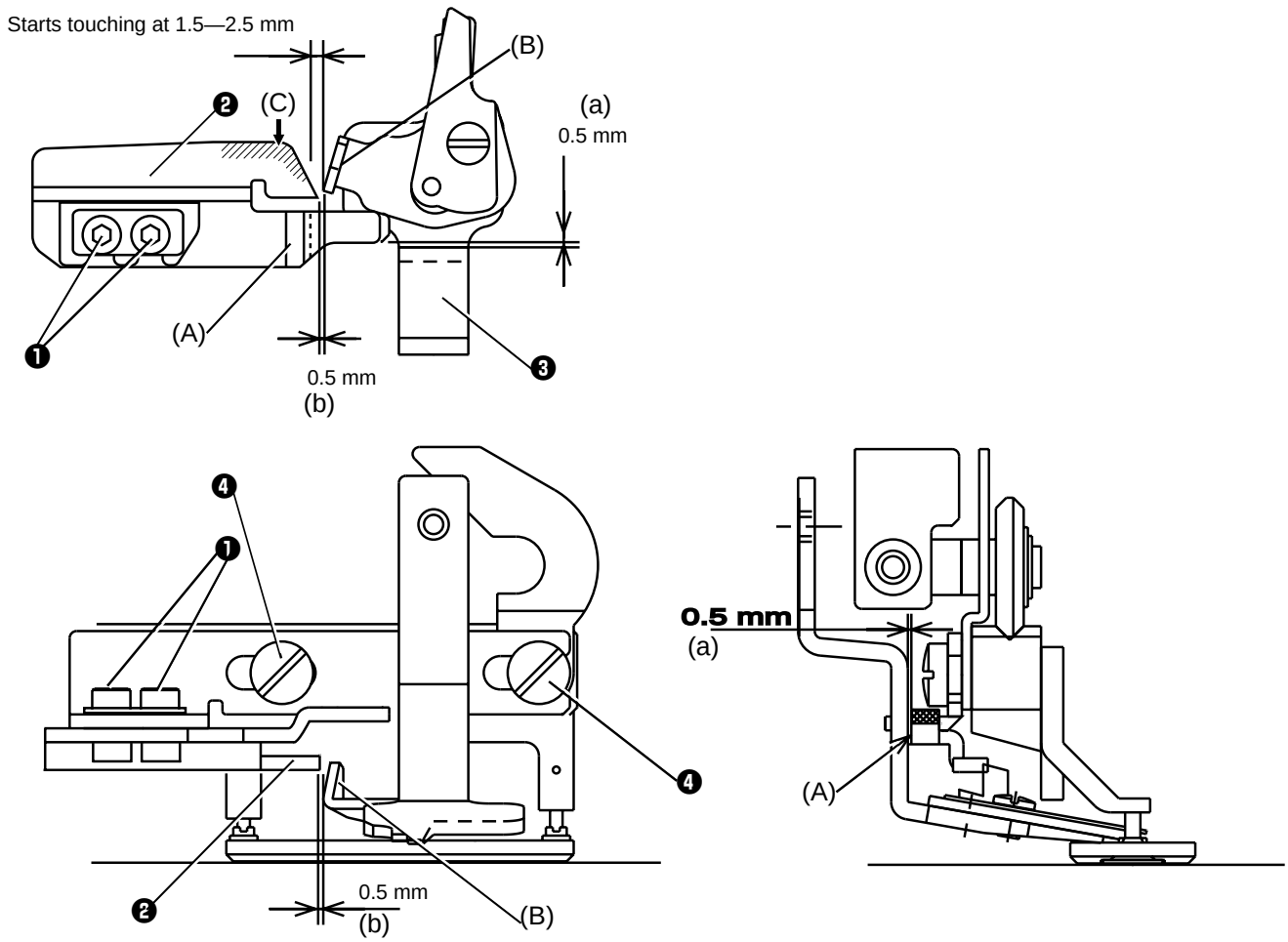
1. Turn off the power (with the feed mechanism at the home position), and then slowly move the trimmer driving arm ❶ forward until the driving arm roller ❷ is at its highest position on the cam of the upper thread trimmer lever ❸.
2. Loosen the screw ❹, and then move the upper thread scissors ❺ up or down to adjust so hat the clearance between the upper thread scissors ❺ and the work clamp ❻ is approximately 1 mm.

NOTE:

The work clamp ❻ will tilt when sewing material joints, so adjust so that the upper thread scissors ❺ do not touch the work clamp ❻. If the upper thread scissors ❺ are touching the work clamp ❻, it may cause the presser foot lifter pulse motor to go out of step.

* If the tilting of the work clamp ❻ causes skipped stitches to occur when sewing material joints, use the accessory auxiliary sheet ❼ as shown in the illustration.

4-13-7. Adjusting the upper thread scissors gradual opening timing



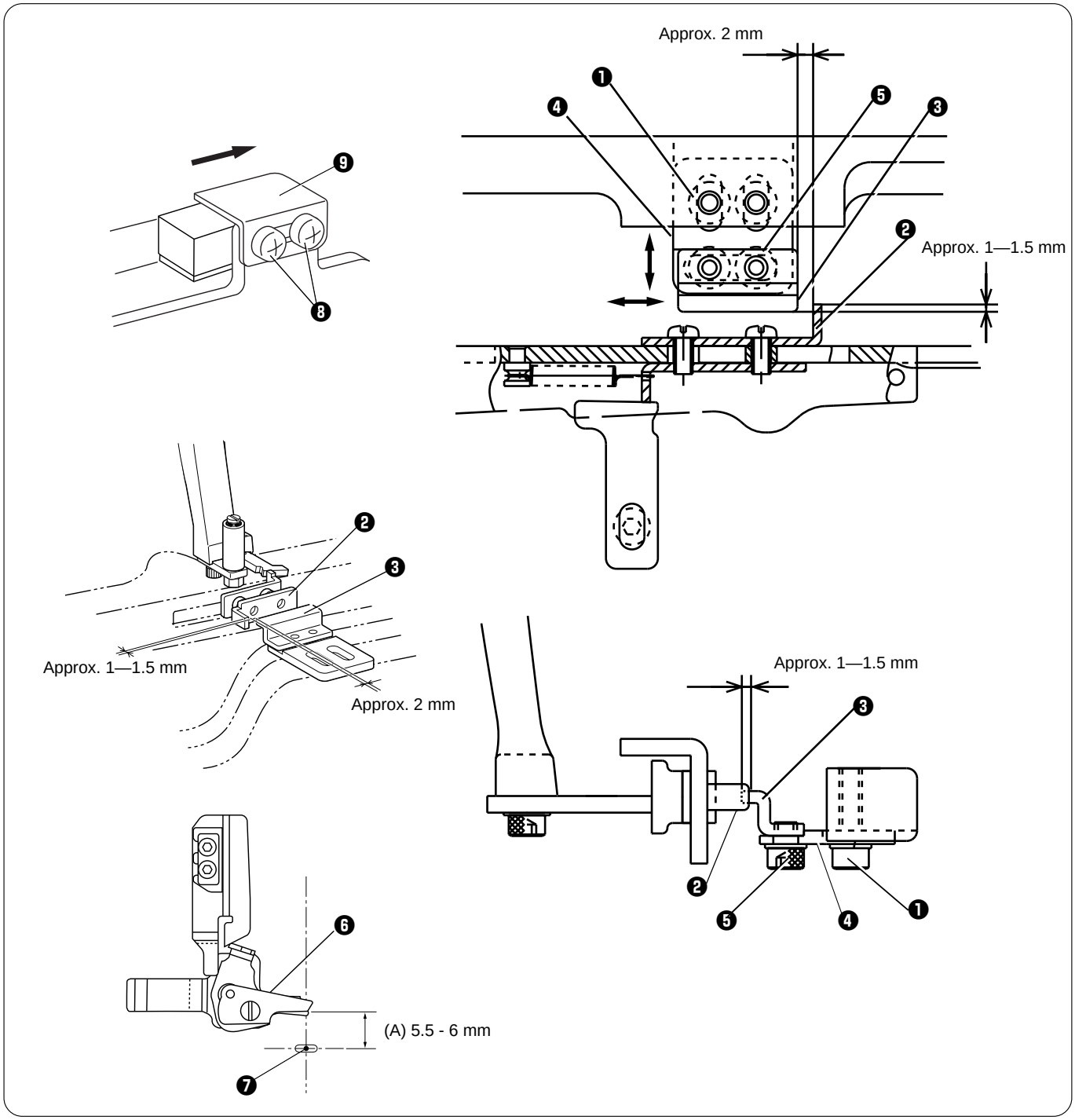
Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Loosen the screws ❶, and then adjust so that the distance (a) between ridge line (A) on the opening cam ❷ and the upper thread scissors ❸ is 0.5 mm, and so that ridge line (A) on the opening cam ❷ is parallel to the feed direction.
2. Loosen the screw ❹, and then adjust so that the distance (b) between the rising section (B) of the upper thread scissors ❸ and the tip of the opening cam ❷ is approximately 0.5 mm when the upper thread scissors ❸ are closed. If you would like the scissors to start opening earlier, make the distance smaller. However, if the distance is too small, check that the work clamp does not touch the rising section (B) of the upper thread scissors ❸ or the opening cam ❷ when it is lowered and prevent the upper thread scissors ❸ from opening.

* Check that the upper thread scissors ❸ gradually start opening after the material has been fed by 1.5—2.5 mm.

* Apply grease to edge surface (C).

4-13-8. Adjusting the upper thread scissors opening timing

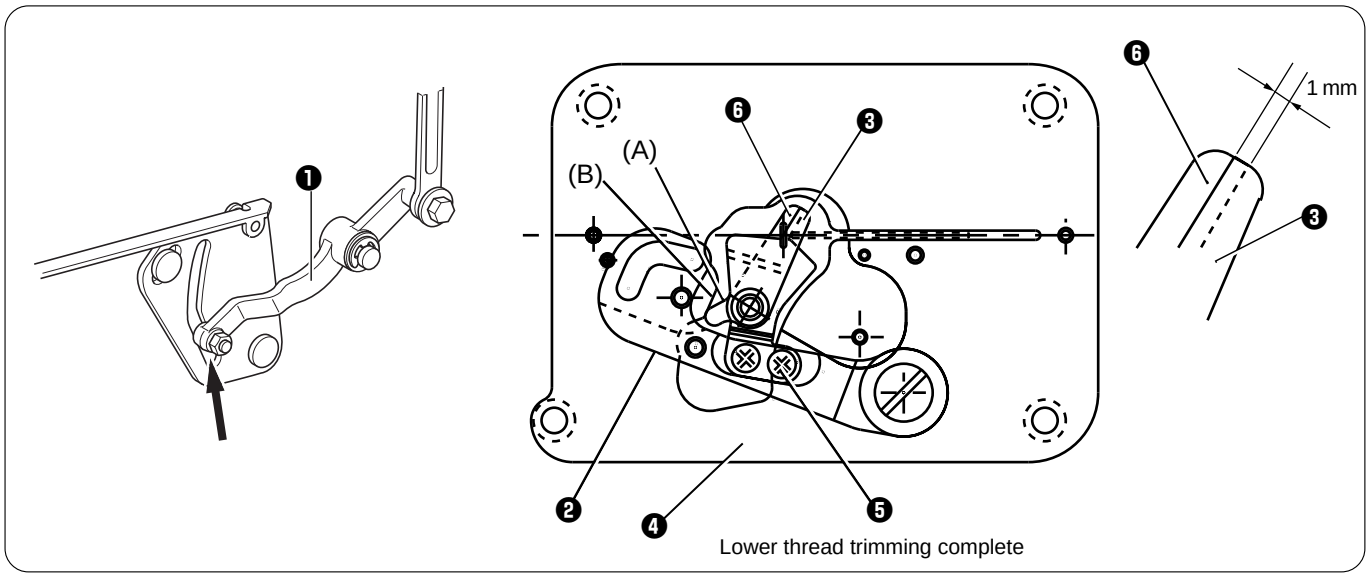


Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Loosen the screw ❶, and then adjust the support plate ❹ so that the back plate ❷ and the cam ❸ overlap by approximately 1—1.5 mm.
   If the amount of overlap is too small, the upper thread scissors will not open properly and the upper thread scissors and the cutter may touch each other.
2. Loosen the screw ❺ to adjust so that the clearance between the back plate ❷ and the cam ❸ is approximately 2 mm. Reduce this clearance if you would like the upper thread scissors to open more quickly.
3. Check that the distance (A) between the upper thread scissors ❻ and the center of the needle ❼ is 5.5—6 mm.
   * If the distance (A) is less than about 4.5 mm, the upper thread scissors ❻ may touch the needle when they open, which may result in needle breakages.
     If the distance (A) is outside the range of 5.5--6 mm, loosen the screw ❽ and move the dog ❾ in the direction of the arrow slightly. Then tighten the screw ❽, turn the power back on, set the sewing machine to the home position nd then press the RESET key to check the adjustment.
4. Check the operation in test feed mode.
   * Refer to the operating procedure given in “1-10. Upper thread trimmer mechanism”.

4-14. Adjusting the lower thread trimming

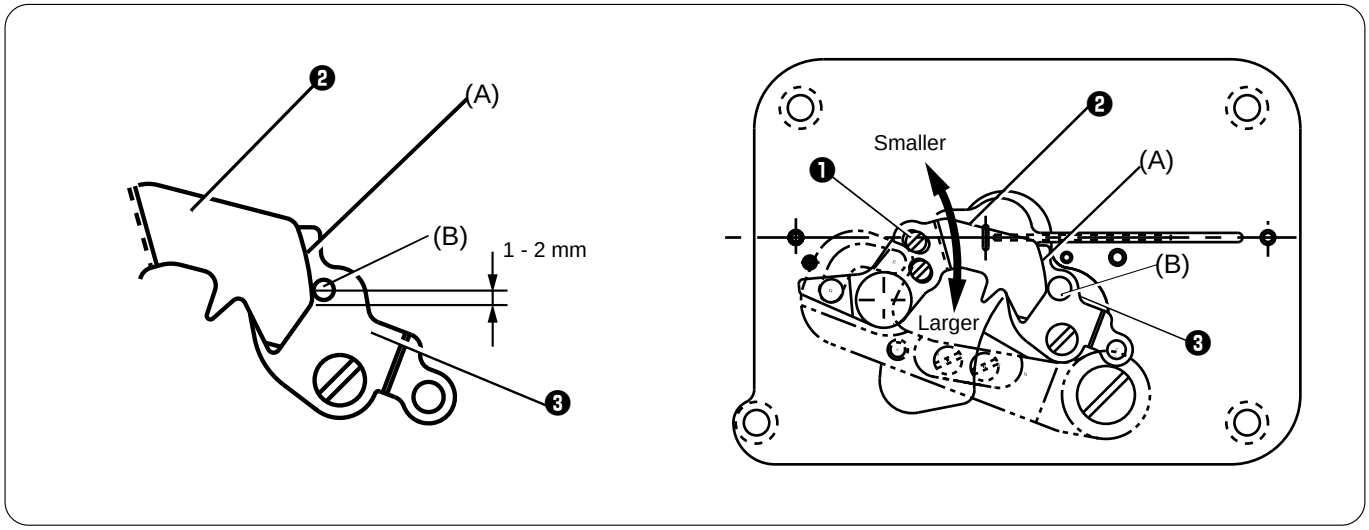
4-14-1. Adjusting the lower thread trimmer fixed knife engagement amount



1. With the power turned off, move the lower thread trimmer cam lever ❶ in the direction of the arrow so that the knife driving lever ❷ is in the position shown in the illustration. Check that the cam (A) of the movable knife ❸ is sitting securely on top of the cam (B) of the base plate ❹.
2. Loosen the screw ❺, and then adjust so that the fixed knife ❻ and the movable knife ❸ are engaged by approximately 1 mm.

* If the engagement amount is too small, the lower thread may not be fully cut, and the material may get caught when it is removed after sewing.

4-14-2. Adjusting the lower thread retaining amount



1. Turn on the power and set the sewing machine to the home position.
2. Loosen the screw ❶, and then adjust the lower thread retainer ❷ to a distance of 1—2 mm as shown in the illustration.

* If the lower thread retaining amount has been reduced, check that the roller (B) of the lower thread clamp plate ❸ is sitting securely on top of the lower thread retainer cam (A).

* If the lower thread is pulling up at the first stitch at the sewing start, check if the lower thread is being pulled out of the lower thread clamp plate ❸, and that it is not too loose when it is coming out from the bobbin case.

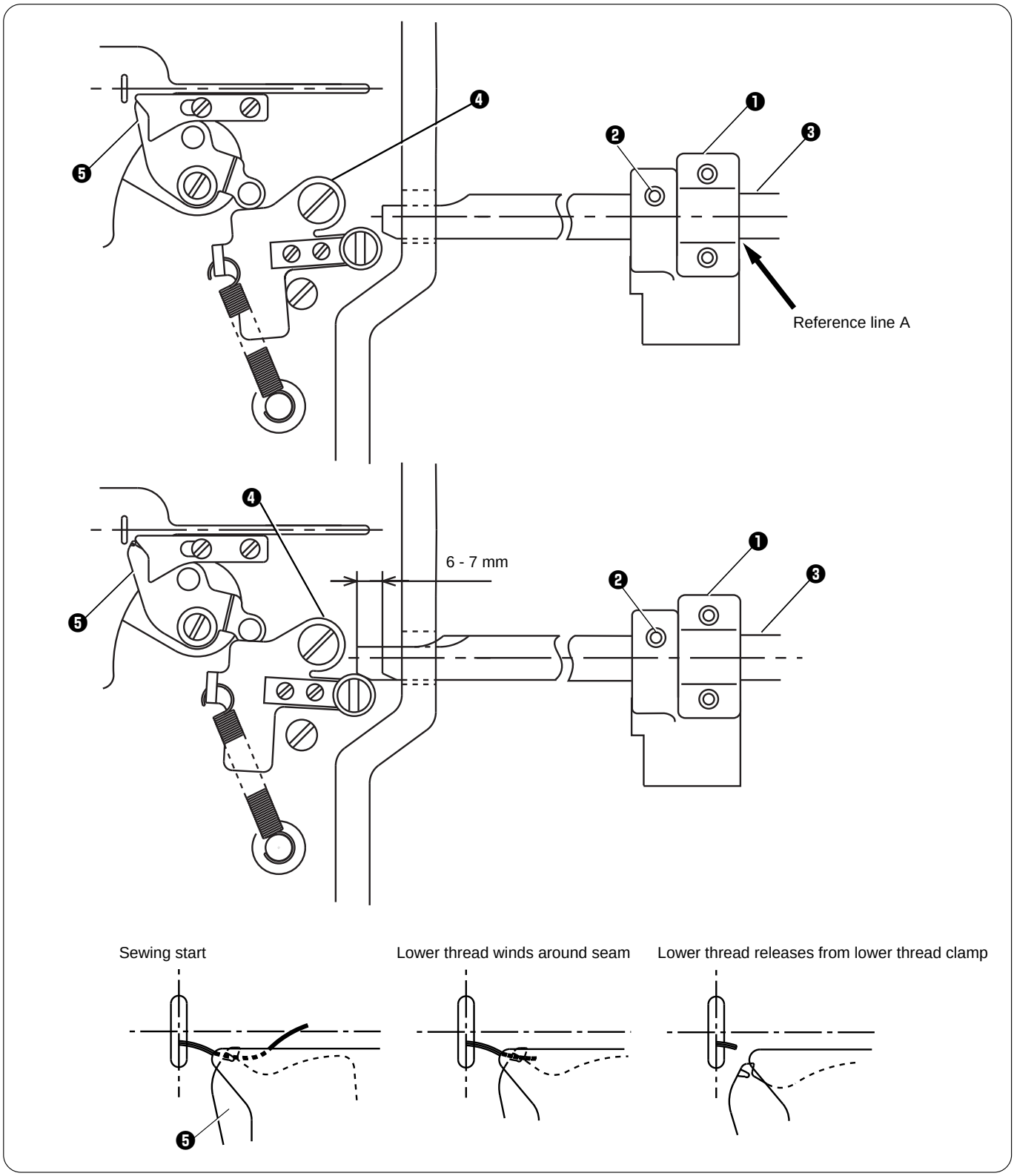
<If the lower thread retaining amount is too small>

The lower thread will pull out of the lower thread clamp plate ❸ at the first stitch at the sewing start, which can cause problems such as lower thread cast-off, lower thread loops or poor lower thread winding.

<If the lower thread retaining amount is too great>

This can cause problems such as poor sealing at the sewing start, or wound lower thread sticking out of the rear tack.

4-14-3. Adjusting the lower thread clamp opening timing

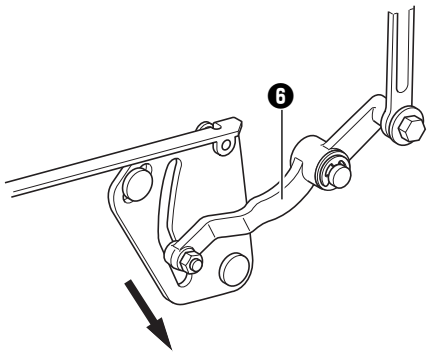


Carry out the adjustment in "4-2. Adjusting the feed home position sensor position" before carrying out this adjustment.

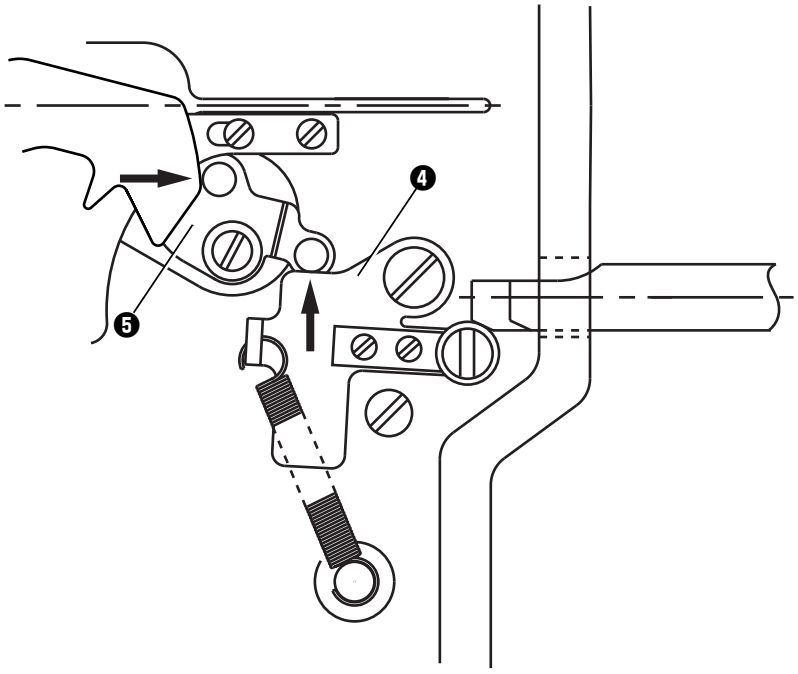
1. Loosen the set screw ❷ of the feed arm support ❶, and then align reference line A of feed guide shaft B ❸ with the edge of the feed arm support ❶. When the feed mechanism moves by 6—7 mm, the opening plate ❹ moves and the lower thread lamp ❺ opens. To change the opening timing, loosen the set screw ❷ and move feed guide shaft B ❸ to the left or right.

* The end of the thread which is being held by the lower thread clamp ❺ is wound around inside the seam. If the opening timing is too early, it can cause problems such as poor winding or pulling-up of the lower thread. If the opening timing is too late, it can cause problems such as stretching, uneven seams or bird’s nests at the sewing start, depending on the type of material.

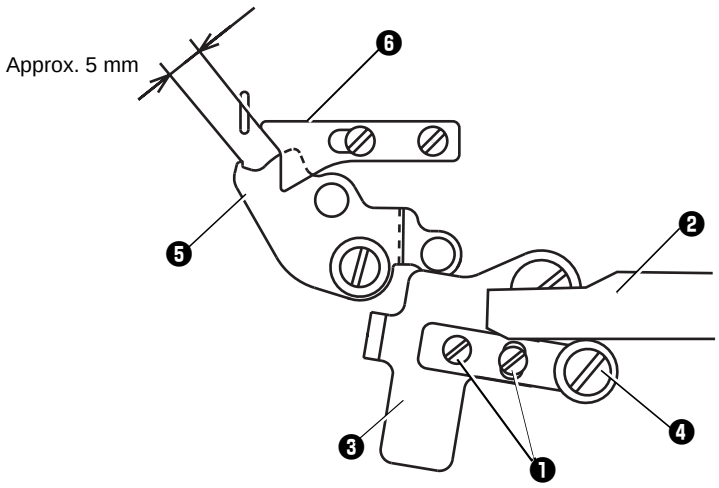
* After moving the lower thread trimmer cam lever ❻ back in the direction of the arrow, move the feed mechanism.



If the feed mechanism is moved when the lower thread trimming has been carried out, the mechanisms will press against each other, which may result in damage to the lower thread clamp ❺ and the opening plate ❹.

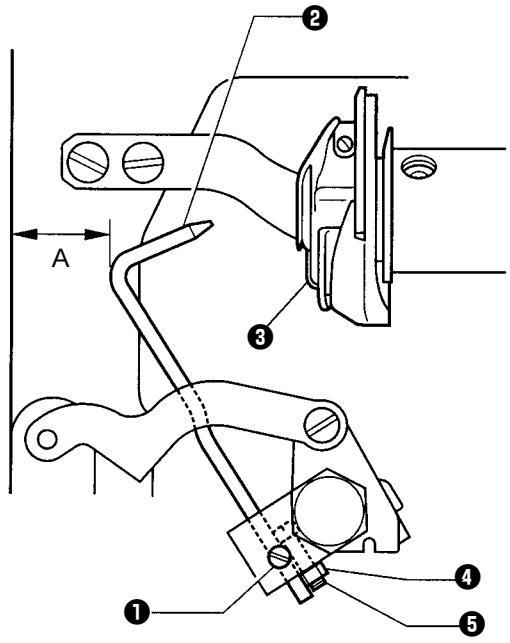


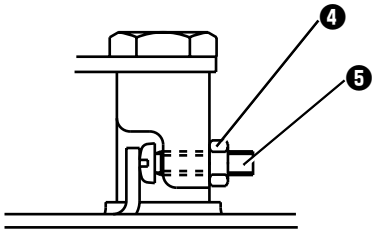
4-14-4. Adjusting the lower thread clamp opening amount

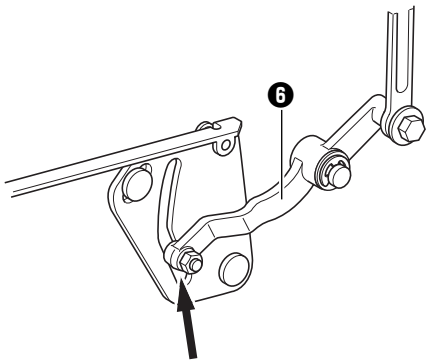


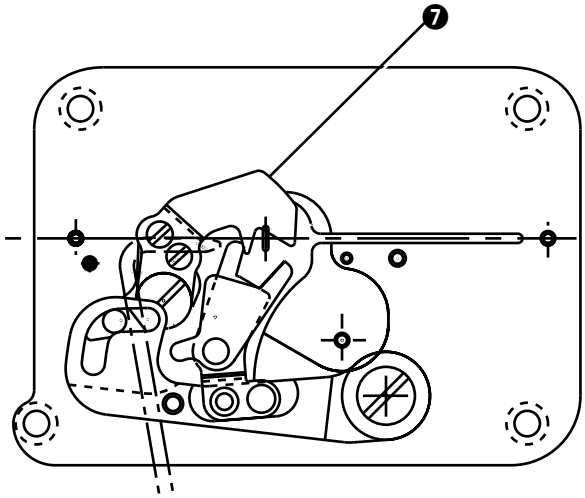
1. Loosen the screws ❶, and then adjust so that the distance between the lower thread clamp ❺ and the lower thread presser ❻ is approximately 5 mm when the feed guide shaft ❷ is projecting out at the front and is firmly touching the roller ❹ of opening plate B ❸.

4-15. Adjusting the bobbin presser







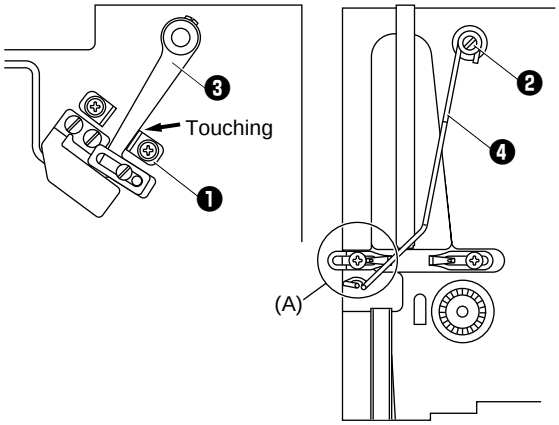


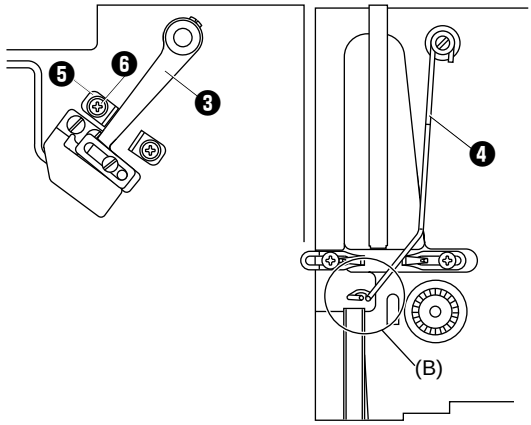
Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

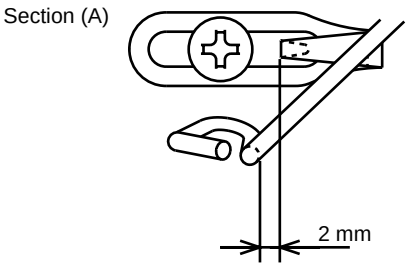
1. Loosen the set screw ❶, and then adjust the bobbin presser ❷ so that it goes into the hole in the bobbin case ❸.
2. Loosen the nut ❹, and then turn the screw ❺ to adjust so that the clearance A between the bobbin presser ❷ and the edge of the bed is approximately 12.5 mm.

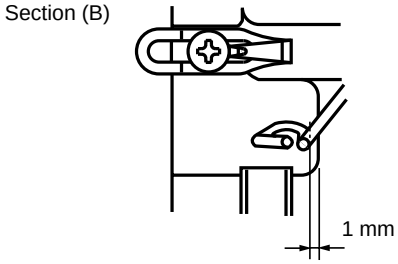
* Turn off the power, move the lower thread trimmer cam lever ❻ by hand in the direction of the arrow so that the bobbin presser ❷ is firmly pressing the bobbin, and then check that the lower thread retainer ❼ is starting to hold the lower thread.
If this timing is reversed, it will cause problems such as an excess trailing length of upper thread.

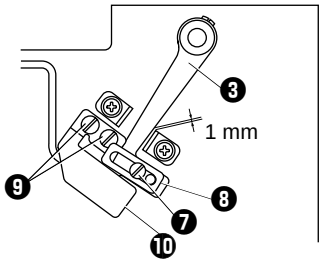
4-16. Adjusting the thread breakage detector

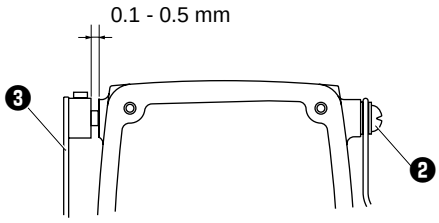








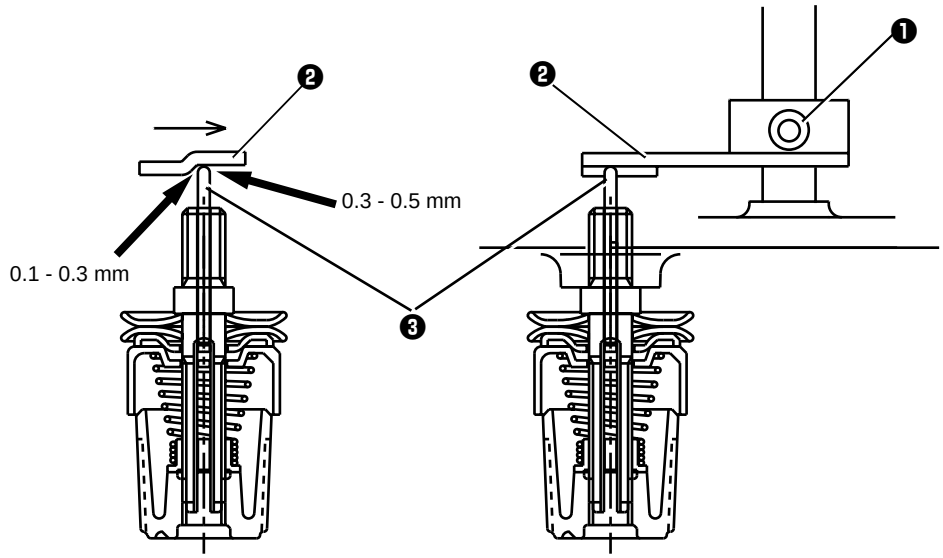




1. Tighten the lever stopper ❶ inside the slotted hole. Loosen the screw ❷, and then adjust so that the distance (A) at the thread guide ❹ is 2 mm when the thread breakage detector lever ❸ and the lever stopper ❺ are touching. After adjusting, tighten the screw ❷.
2. Loosen the screw ❻ of the lever stopper ❺, set so that distance (B) at the thread guide ❹ is 1 mm, and then touch the thread breakage detection lever ❸ against the stopper ❺.
3. Loosen the screw ❼, and then change the position of the balancer ❽ to adjust the balance between the thread breakage detection lever ❸ and the thread guide ❹.
4. Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.
5. Loosen the screw ❾, and then adjust so that the thread breakage detector sensor ❿ turns on (LED illuminates) when the distance between the thread breakage detection lever ❸ and the lever stopper ❶ is 1 mm.

* When the thread guide ❹ is moved to position (B) and then released, check that it moves smoothly back to position (A).
If it does not move smoothly, check that the clearance between the thread breakage detection lever ❸ and the arm is 0.1—0.5 mm.

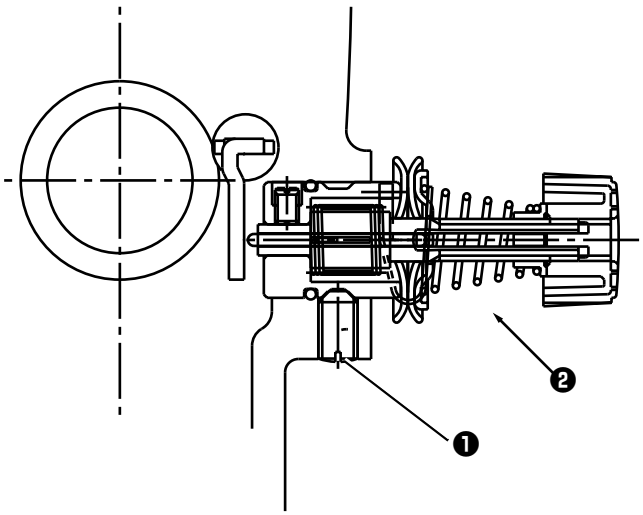
4-17. Adjusting the thread tension at the tack tension control



Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Loosen the screw ❶, and then adjust the clearances between the tension release cam ❷ and the tension release pin ❸ as shown in the illustration.
2. Press the RESET key, and check that the tension disc opening amount is 0.5—1.0 mm when the presser foot is raised. In addition, press the RESET key once more and check that the tension discs are fully closed when the presser foot is lowered.

4-18. Adjusting the thread tension at the zigzag tension control



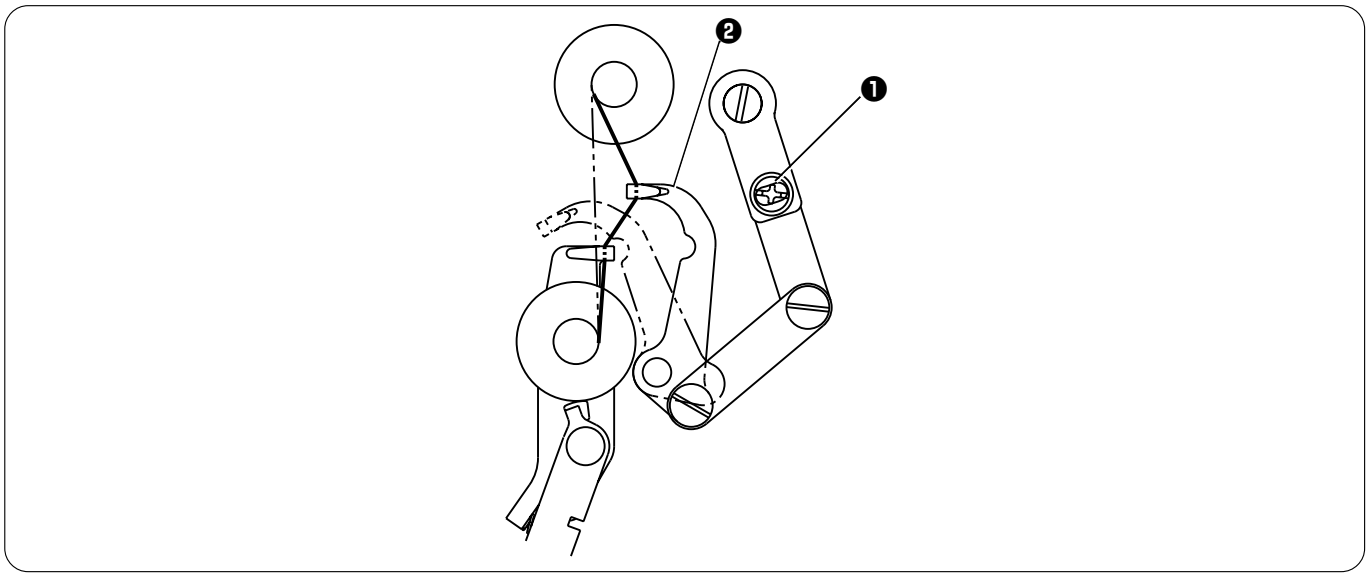
Position the tension release solenoid as described in "3-5. Tension release mechanism" before carrying out this adjustment.

Turn on the power and set the sewing machine to the home position. Then press the RESET key to lower the presser foot.

1. Loosen the screw ❶, and then move the tension stud bracket assembly ❷ in and out to adjust so that the tension disc opening amount is 0.5—1.0 mm.

* Check that the tension discs are fully closed when the power is turned off.

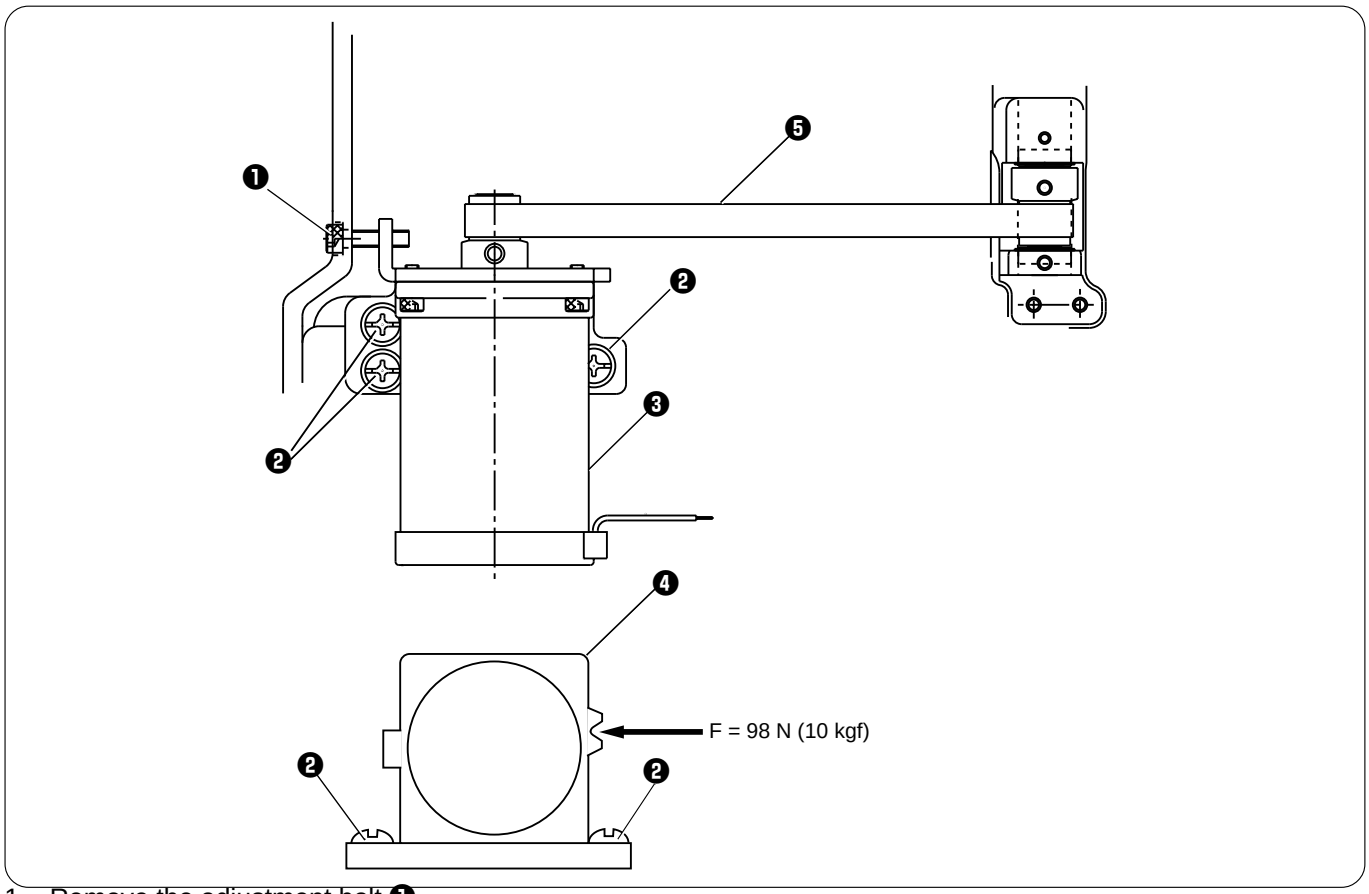
4-19. Adjusting the upper thread feeding amount



1. Loosen the screw ❶, and then turn the tension take-up lever ❷ to adjust the upper thread feeding amount.

* Move the trimmer driving arm by hand and check that upper thread feeding is completed before the upper thread is cut. If the above adjustment is not made, it may result in the upper thread pulling out or in upper thread clamping errors.

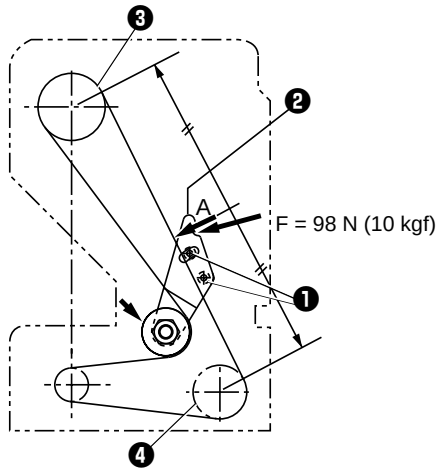
4-20. Adjusting the feed timing belt



1. Remove the adjustment bolt ❶.
2. Loosen the three screws ❷ so that the feed pulse motor ❸ moves easily.
3. While using a spring gauge to push the notch in the motor mounting bracket ❹ with a force of 98 N, tighten the screws ❷.
4. Check that the timing belt ❺ moves smoothly.
5. Gently tighten the adjustment bolt ❶.

If you do not have a spring gauge, loosen the three screws ❷ and adjust using the adjustment bolt ❶. Adjust the tension so that the amount of belt deflection is approximately 3.5 mm when a force of 5 N is applied in the middle of the belt span.

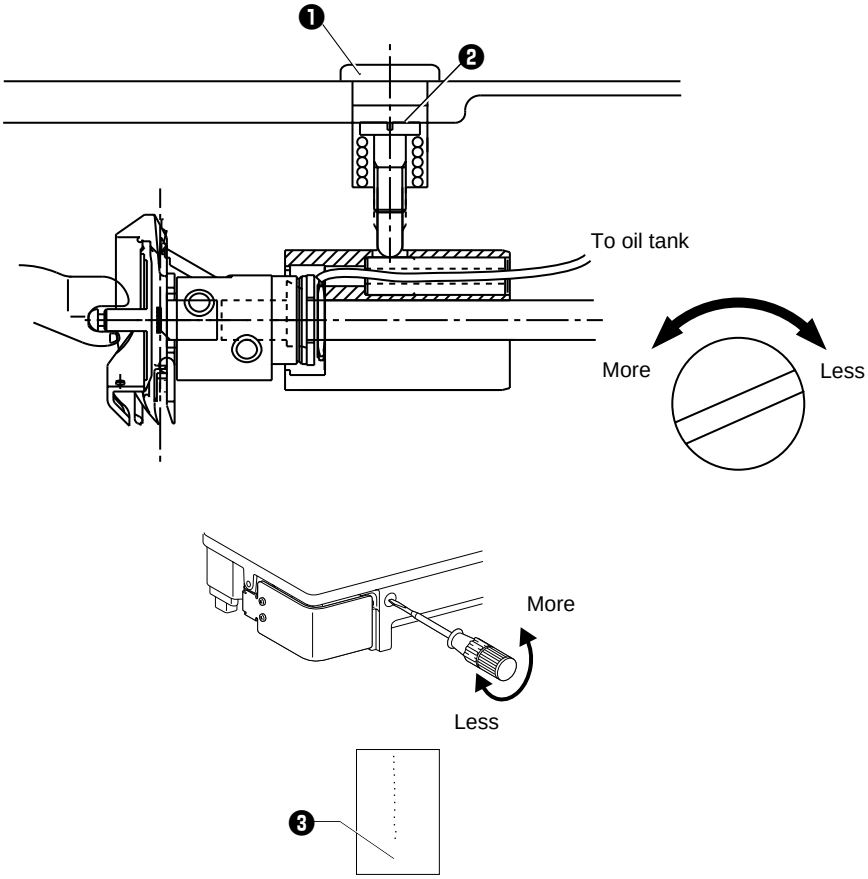
4-21. Adjusting the upper shaft timing belt



1. Loosen the screws ❶, and then use a spring gauge to push the notch in the tension pulley plate ❷ with a force of 98 N.
2. Tighten the screws ❶.

If you do not have a spring gauge, adjust the tension so that the amount of belt deflection is approximately 5 mm when a force of 5 N is applied in the middle of the belt span between timing pulley U ❸ and the idle pulley ❹ in the place indicated by arrow A.

4-22. Adjusting the rotary hook lubrication

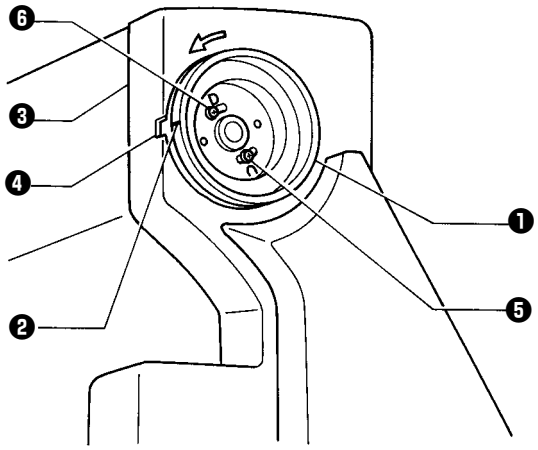


1. Remove the rubber stopper ❶.
2. Turn the adjusting screw ❷ to adjust the lubrication amount.

* Adjust so that approximately 10 drops of oil are released when the sewing machine is run at a speed of 4000 rpm for three cycles to sew about 114 stitches. Use Kraft paper ❸ or similar to catch the oil drops. As a guide, the optimum position can be obtained if the adjusting screw is tightened as much as possible and then loosened about two turns.

* If the lubrication amount has been reduced, run the machine for 200—300 sewing cycles and then check it again. If lubrication stops, it will cause problems such as rotary hook seizure and thread breakages.

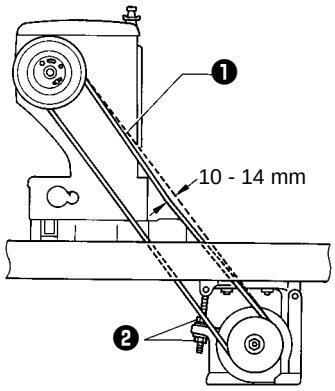
4-23. Adjusting the needle up stop position



1. The needle up stop position is adjusted so that the index mark ❷ on the machine pulley ❶ is inside the mark ❹ on the belt cover ❸. If adjustment is necessary, loosen the screw ❺ of the machine pulley ❶ and adjust the position of the machine pulley ❶. The machine pulley ❶ stops later if it is turned clockwise, and it stops earlier if it is turned counterclockwise.
   The screw ❻ is a screw for detecting the machine stop position, and should not be loosened.

NOTE:
If the index mark ❷ is not inside the mark ❹ when the sewing machine is started, error code “E-02” will be displayed. Turn the machine pulley ❶ to move the index mark ❷ to the correct position and then start the sewing machine.

4-24. Adjusting the V-belt tension



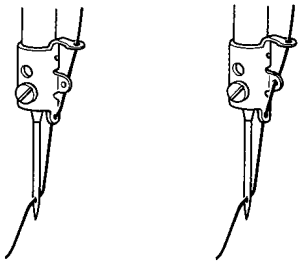
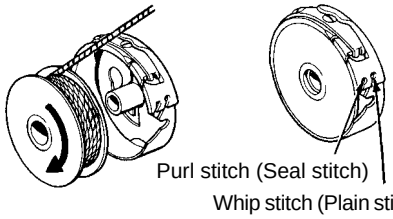
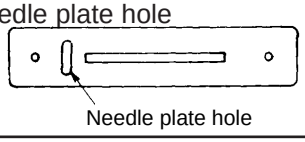
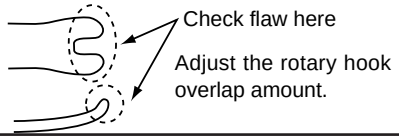
1. Remove the screw, and then remove the belt cover.
2. Turn the two nuts ❷ to adjust so that there is 10—14 mm of deflection in the V-belt ❶ when it is pressed at the midway point with a force of 5 N.

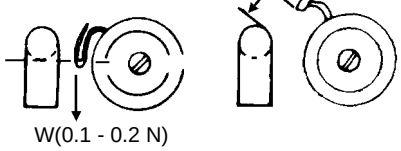
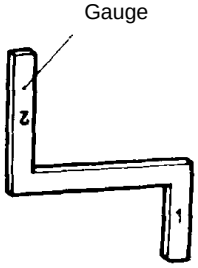
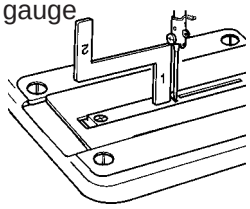
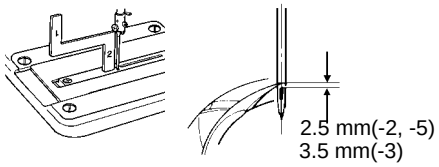
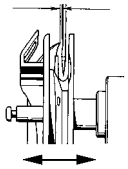
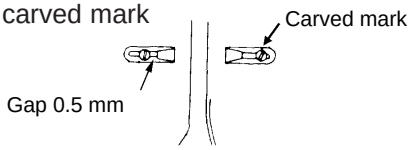
NOTE:
If the V-belt is too loose, or if the V-belt is stretched, the following problems could occur.
   a. The stopping position may shift;
   b. The needle bar may drift when the sewing machine stops;
   c. An extra stitch may be sewn when the sewing machine stops;
   d. An abnormal noise may be heard due to the V-belt slipping; or
   e. The V-belt may become too loose and contact the cover.

If any such problems occur, adjust by following the procedure described above.

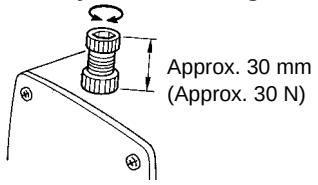
5. TROUBLESHOOTING GUIDE

5-1. Needle thread breakage

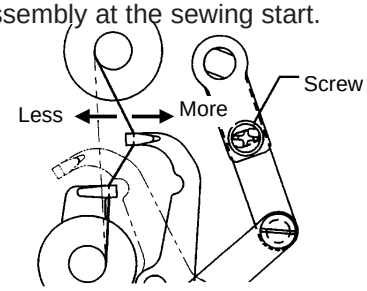
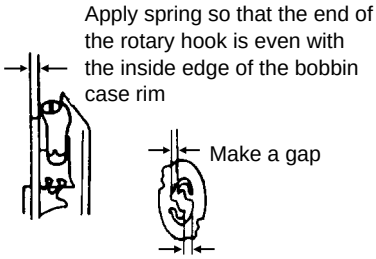
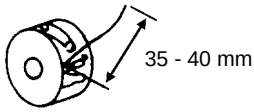
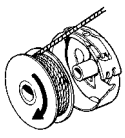
Cause	Check	Solution		page
Needle	Needle facing	Reattach needle properly	As viewed from the direction of the face plate, attach needle so that the notched part of needle faces frontward	- (Instruction)
	Needle installation height	Install the needle at the correct height.	Insert the end of the needle shank so that it touches the top edge of the needle hole of the needle bar.	- (Instruction)
	Bent needle	Replace needle		-
	Blunt needle tip or burr	Replace needle		-
	Needle and thread	Replace needle that fits the thread		-
Threading	Needle thread threading	Rethread properly	Cutton, spun yarn Man-made fiber filament yarn 	- (Instruction)
	Bobbin thread threading	Rethread properly		- (Instruction)
Thread path	Flaw or abrasion on the thread path	Polish with buff Replace the part	Especially, pay attention to finishing around needle plate hole 	-
	Rotary hook point Rotary hook edge	Polish with buff Replace the part		-
	Flaw on the rotary hook holder	Polish with buff Replace the part		4-8
Thread tension	Sub thread tension (Zigzag chain stitch)	Adjust the needle thread tension	1 - 2.2N tension for spun yarn #50 - #60 Bobbin thread tension Whip stitch 0.15 - 0.25N Purl stitch 0.05 - 0.15N (Holding the thread steady, the bobbin case should gently descend under the force of its own weight)	- (Instruction)
	Main thread tension	Adjust the needle thread tension	Adjust it while checking stitches	- (Instruction)

Cause	Check	Solution		page
Thread take-up spring	Thread take-up spring tension and stroke	Adjust thread take-up spring tension and stroke	tension 4 - 6 mm stroke  Loosen the tension or shorten the stroke to such a degree that does not cause double hooking Adjust it while checking bar tacking stitches	- (Instruction)
Rotary hook	Needle height when rotary hook point aligned with needle center (Needle bar height and needle bar rise)	Adjust its timing Three kinds of gauges are available For -2, for -3 and for -5  	Adjust the needle bar height to "1" on the gauge  Adjust needle bar height to "2" on the gauge  	4-6
	Gap between needle and rotary hook	Adjust the gap	Widen the gap (0.01 - 0.08 mm) to such a degree that rotary hook point does not strike needle in zigzag motion 0.01 - 0.08 mm 	4-6
	Rotary hook lubrication	Adjust the quantity of lubrication oil	Too small quantity of lubrication oil will cause thread breakage * Check the quantity of lubrication as follows; When the number of stitches is about 114, sew 20 stitches and using craft paper, check that the number of splashed oil spots is about 10	4-27
	Thread twisted around rotary hook	Remove any twisted thread from the inner and outer rotary hook.		-
Needle thread take up	Arm thread guide position	Adjust arm thread guide position	Adjust the center of screw to the carved mark  	-
Bobbin case	Damaged outside of bobbin case Bent bobbin holder spring, etc.	Polish with buff Replace the part	Use the B800E bobbin case.	-

5-2. Skipped stitches

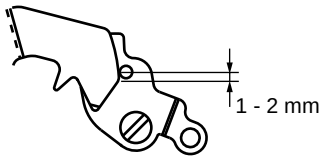
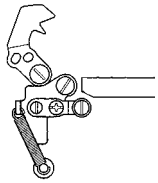
Cause	Check	Solution		page
Needle	Needle facing	Refer to "5-1. Needle thread breakage"		
	Needle installation height			
	Bent needle			
	Blunt needle tip or burr			
	Thin needle	Replace needle	Use a needle with a count that matches the thread and material.	-
Thread take-up spring	Thread take-up spring tension and stroke	Refer to "5-1. Needle thread breakage"		
Upper clamping foot	Upper clamping foot pressure	Increase upper clamping foot pressure	Presser adjustment screw height is approximately 30 mm, so tighten it. 	4-8
	Relation between upper clamping foot and sewing length	Replace upper clamping foot that fits for sewing length	When using knits or woven materials, replace the parts with the -3 specification parts; Length feed plate (for subclass -3) Upper clamping foot (for knits) Needle plate 1.2 (for subclass -3)	-
Rotary hook	Blunt rotary hook point	Polish with buff Replace rotary hook		-
	Needle height when rotary hook point aligned with needle center (Needle bar height and needle bar rise)	Refer to "5-1. Needle thread breakage"		
	Gap between needle and rotary hook			
Tension	Strength of sub thread tension (zigzag portion)	Adjust the upper thread tension to the appropriate tension.		- (Instruction)
Needle bar play	Vertical and longitudinal needle bar play	Reduce the needle bar play, or replace the parts.		-
Lower thread clamp	Lower thread retainer cam should be sitting firmly on lower thread clamp plate roller.	Refer to "4-14. Adjusting the lower thread trimming"		
	Thread scraps and dust blocking area around lower thread clamp and lower thread presser	Clean around the lower thread presser.		-
Needle plate	Material and needle plate	When using knit material, replace with the -3 needle plate. Replace with a needle plate with a smaller needle hole.	Using the thin -5 needle plate and flat work clamp can be effective.	-
Joint sewing	Angle of work clamp means that material is not being clamped.	Replace with short work clamp that matches the sewing length. Use the accessory auxiliary sheet.	Process the work clamp assembly to match the joint section. (Attach or remove rubber.)	4-16

5-3. Uneven seams 1).....Beginning of sewing (1)

Cause	Check	Solution		page
Upper thread scissors	Installation height	Install the upper thread scissors at the correct height.		4-16
	Upper thread scissors opening timing	Adjust to an appropriate opening timing.		4-17 4-18
Upper thread feeding	Thread take-up	Decrease thread take-up	Loosen the screw to decrease thread take-up so that upper thread does not pull out of scissors assembly at the sewing start. 	4-26
Bobbin thread (bobbin slip)	Bobbin thread tension	Increase bobbin thread tension	Bobbin thread tension Whip stitch 0.15 - 0.25N Purl stitch 0.05 - 0.15N (Holding the thread steady the bobbin case should gently descend under the force if its own weight)	- (Instruction)
	Spring	Apply spring		-
	Lower thread retainer position	Adjust lower thread retainer position	Adjust lower thread retainer so that a 35 - 40 mm thread leader is left after trimming 	4-19
	Bobbin presser position	Adjust the bobbin presser.		4-23
	Bobbin insertion	Insert the bobbin correctly.		- (Instruction)
	Presser foot lifting speed	Reduce the setting for memory switch No. 02.		- (Instruction)

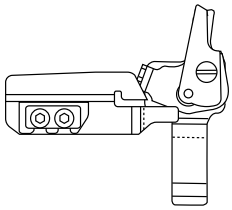
Beginning of sewing (2) Lower thread lifted up

* The end of the lower thread protrudes above the seam at the sewing start

Cause	Check	Solution		page
Lower thread retainer	Lower thread retaining amount	Adjust the lower thread retaining amount.		4-19
Lower thread clamp	Lower thread clamp timing	Adjust so that the lower thread clamp plate opens when the feed mechanism moves 6 -- 7 mm. Adjust the lower thread clamp opening timing.		4-20

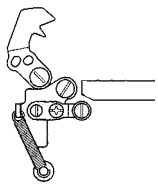
Beginning of sewing (3) Seam lifts up

* Seam lifts up and does not tighten at the sewing start

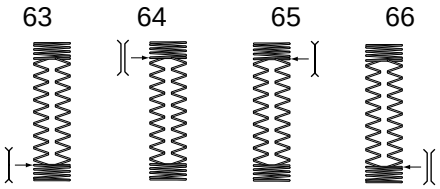
Cause	Check	Solution		page
Upper thread scissors	Upper thread scissors gradual opening timing	Adjust the gradual opening timing of the upper thread scissors.	 Upper thread scissors gradually start opening when the feed mechanism moves about 1.5 -- 2.5 mm.	4-17
Upper thread feeding	Refer to "5-3. Uneven seams 1).....Beginning of sewing (1)"			

Beginning of sewing (4) Uneven sewing pitch

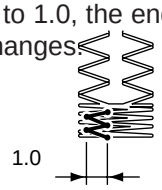
* Bird's nests form at the sewing start, and after 5 -- 6 mm the sewing pitch suddenly increases.

Cause	Check	Solution		page
Lower thread clamp	Lower thread clamp timing	Adjust the opening timing of the lower thread clamp.	Advance the timing at which the lower thread clamp starts to open. 	4-20

5-4. Uneven seams 2).....Around rear tack or front tack

Cause	Check	Solution		page
Thread release	Tension release timing	Use the parameter switches to change the on and off timing.		- (Instruction)
Threading	Refer to "5-1. Needle thread breakage"			
Zigzag tension	Zigzag tension disc opening	Adjust the opening of the tension discs.		4-25

5-5. Uneven seams 3).....Loose thread end at end backtack (1)

Cause	Check	Solution		page
Backtack shape	Check the backtack shape	Set the value for parameter No. 68 to 1.0.	When the value for parameter No. 68 is set to 1.0, the end backtack shape changes 	- (Instruction)

Thread sticking out at end backtack (2)

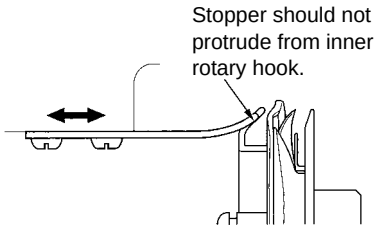
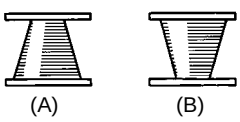
Cause	Check	Solution		page
Backtack shape	Refer to "5-5. Uneven seams 3).....Loose thread end at end backtack (1)"			
Uneven material feeding	Presser foot pressure	Increase presser foot pressure		4-8
	Upper clamping foot	When using knit material, replace with the -3 thread clamp and needle plate.	Using the thin -5 needle plate and flat work clamp can be effective.	-
	Upper thread scissors opening timing	Adjust to an appropriate opening timing.		4-17 4-18
	Lower thread clamp opening timing	Adjust to an appropriate opening timing.		4-20

5-6. Uneven seams 4).....Sticking in needle plate

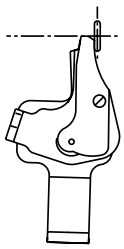
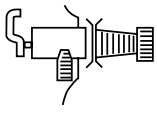
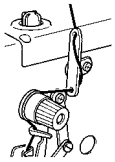
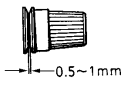
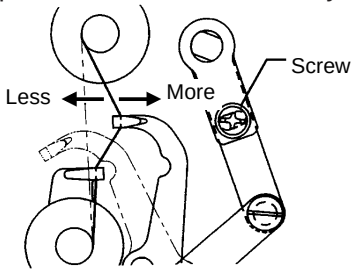
* Front and rear tack sections of material gets stuck in needle hole

Cause	Check	Solution		page
Start backtack	Start backtack	Reduce the number of front tack stitches (parameter No. 40).	If the material is soft, setting to 0 stitches may help.	- (Instruction)
Rear tack	Rear tack vector shape	Change the rear tack vector shape to rectangle (parameter No. 37).	When the rear tack vector shape is set to rectangle, it can help to set the tack width to a narrower width.	- (Instruction)
Needle plate	Needle plate	When using knit material, replace with the -3 needle plate. Replace with a needle plate with a 1.2 needle hole.	Using the thin -5 needle plate and flat work clamp can be effective.	-

5-7. Uneven seams 5).....All stitches

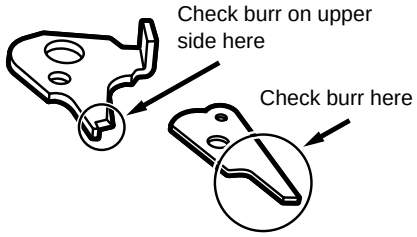
Cause	Check	Solution		page
Threading	Needle thread threading	Refer to "5-1. Needle thread breakage"		
	Bobbin thread threading			
Needle	Needle attachment	Reattach needle properly	Insert needle fully into needle bar	- (Instruction)
	Needle number count	Replace needle with thicker one		-
Thread chips or dust	Rotary hook rim Rotary hook edge Around needle plate hole	Remove thread chips or dust		-
Needle thread	Needle thread tension	Increase needle thread tension	Adjust tension while checking stitches	-
	Thread and needle	Replace needle with one that fits for the thread		-
Rotary hook holder	Flaws on rotary hook holder	Refer to "5-1. Needle thread breakage"		
	Rotary hook stopper and inner rotary hook overlap amount	Adjust the rotary hook stopper and inner rotary hook overlap amount		4-8
Rotary hook	Lubrication	Decrease the quantity of lubrication oil	Adjust it with oil adjusting shaft Check the quantity of lubrication as follows; When the number of stitches is about 114, sew 20 - 30 stitches and using the craft paper check that the number of splashed oil spots is about 10 Too small quantity of lubrication oil will cause thread breakage	4-27
Bobbin winder thread guide	Bobbin thread tension	Adjust the tension on the bobbin winder guide	Decrease the tension to such a degree that it does not cause bobbin thread winding turbulence	-
	Uneven bobbin winding	Move bobbin winder guide up and down to adjust its position	Move it up in case (A) Move it down in case (B) 	- (Instruction)
Bobbin thread	Bobbin thread tension	Adjust the bobbin thread tension		- (Instruction)
Bobbin case	Refer to "5-1. Needle thread breakage"			
Stitch patterns	Purl stitch, Whip stitch	Parameter No. 11 setting		- (Instruction)

5-8. Needle thread runout

Cause	Check	Solution		page
Upper thread trimmer assembly	Upper thread trimmer assembly position	Move the setting plate assembly to adjust the scissors assembly setting position. (Upper thread scissors longitudinal position adjustment) Upper thread scissors cutting depth adjustment		4-14 4-15
	Operating pressure of upper thread trimmer assembly	Correct operating pressure by upper thread upper trimmer	Adjust the operating pressure as follows; After thread trimming, pick the pinched thread and shake lightly Check that the thread does not take off upper thread trimmer assembly Cotton yarn #60 Holding force approx. 2 N	-
	Upper thread trimmer driving spring	Change if transformed		
Tension release timing	End of tension release at the beginning of sewing	Retard the tension release timing	Change using parameter No. 63	- (Instruction)
	Opening amount of zigzag tension discs and bar tack tension discs	Adjust the release dimension	Adjust the zigzag tension discs by moving the tension stud bracket in and out. Adjust the bar tack tension disc opening amount to 0.5 -- 1 mm by removing the top cover and moving the tension release cam.  Zigzag tension  Tack tension  0.5~1mm	4-25
Upper thread feeding	Needle thread take-up	Increase needle thread take-up	Increase thread take up to a degree that needle thread does not take off upper thread trimmer assembly  Screw Less More	4-26

Cause	Check	Solution		page
Rotary hook	Needle height when rotary hook point aligned with needle center (Needle bar height and needle bar rise)	Refer to "5-1. Needle thread breakage"		
	Thread chips on rotary hook edge	Remove thread chips	Especially, check it in case needle thread is man-made fiber filament yarn	-
Machine stopping position	Upper shaft pulley stopping position	Adjust the needle up sensor position.	Refer to instruction manual	
Bobbin thread	Lower thread retaining amount	Refer to "5-3. Uneven seams 1).....Beginning of sewing (2) Lower thread lifted up"		
	Lower thread snapping	Reduce the lower thread retaining speed (presser foot rise speed).	Change using the memory switch.	- (Instruction)
	Lower thread snapping	Lower thread retainer, lower thread clamp and lower thread presser plate finish	Finish so that lower thread does not snap.	-
	Lower thread clamp timing	Refer to "5-3. Uneven seams 1).....Beginning of sewing (2) Lower thread lifted up"		
Sewing start speed	Slow speed	Reduce the slow start speed.		- (Instruction)
	Slow start stitches	Reduce the number of slow start stitches.		- (Instruction)
Bar tack thread tension	Bar tack thread tension is too strong.	Adjust so that whip stitches are formed at the sewing start.		- (Instruction)
Upper thread breakage	Upper thread breaks.	Refer to "5-1. Needle thread breakage"		

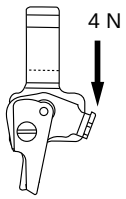
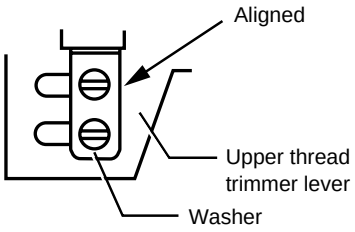
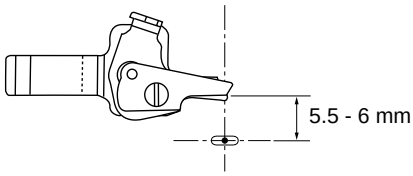
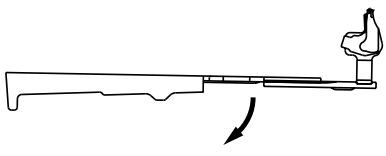
5-9. Unraveling of thread trimmed by upper thread trimmer assembly

Cause	Check	Solution		page
Upper thread trimmer assembly	Upper thread trimmer assembly position	Refer to "5-8. Needle thread runout"		
	Burr on tips of upper thread trimmer and upper thread upper trimmer	Polish with buff Replace the part		-
Tension release timing	Opening amount for zigzag tension discs and bar tack tension discs (particularly zigzag tension discs)	Refer to "5-8. Needle thread runout"		
Upper clamping foot	Presser foot rise speed	Reduce the presser foot rise speed.	Change using memory switch No. 02..	- (Instruction)

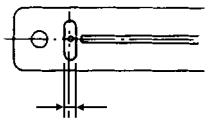
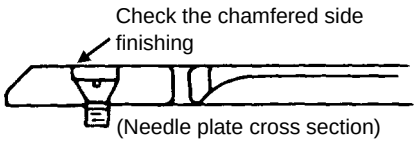
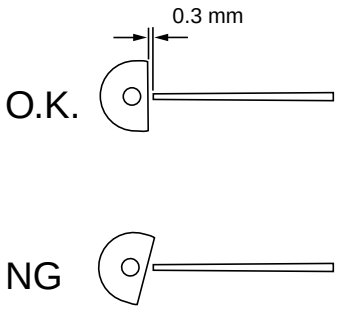
5-10. Needle thread mis-trimming

Cause	Check	Solution		page
Upper thread trimmer assembly	Upper thread trimmer assembly position	Refer to "5-8. Needle thread runout"		
	Operating pressure of upper thread trimmer assembly			
	Upper thread trimmer driving spring			
Trimmer driving arm	Upper thread scissors cutting depth (clearance between scissors assembly and presser roller bracket)	Adjust the position of the trimmer driving arm roller.	Adjust the upper thread scissors cutting depth.	4-15

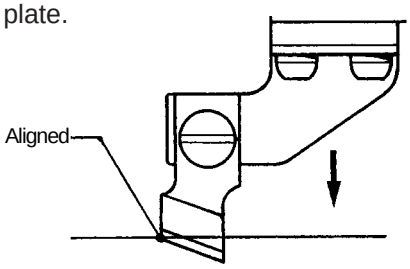
5-11. Needle strikes upper thread trimmer

Cause	Check	Solution		page
Upper thread trimmer assembly	Upper thread trimmer assembly position	Refer to "5-8. Needle thread runout"		
	Upper thread scissors operating force	Adjust so that scissors M open when the projection is pressed with a force of 4 N or less, and remove any scratches and burrs.		-
Longitudinal feed arm	Longitudinal feed arm position	Adjust properly	Move the upper thread trimmer driving link so that it stops at the face plate. In this position, tighten the eye bolt so that the small slot in the upper thread trimmer lever and the edge of the washer are aligned. 	4-13
Thread take-up position in stopped condition	Upper shaft pulley stopping position	Refer to "5-8. Needle thread runout Machine stopping position"		
Cam	Upper thread scissors opening timing adjustment	The cam should open the stop plate properly.	Refer to "4-13-8. Adjusting the upper thread scissors opening timing"	
Opening cam	Upper thread scissors gradual opening timing	Refer to "4-13-7. Adjusting the upper thread scissors gradual opening timing"		
Presser foot home position sensor	Presser foot home position sensor position	After setting to the home position, press the RESET key to lower the presser foot, and adjust so that the distance from the upper thread trimming scissors to the center of the needle is 5.5 -- 6 mm at this time.		4-5
Upper thread trimmer lever	Upper thread trimmer lever operating force	The upper thread trimmer lever should gently open when the stop plate is separated from the stopper.		-

5-12. Needle breakage

Cause	Check	Solution		page
Needle	Needle facing	Reattach needle properly	As viewed from the direction of the face plate, attach needle so that the notched part of needle faces frontward	- (Instruction)
Rotary hook	Needle height when rotary hook point aligned with needle center (Needle bar height and needle bar rise)	Refer to "5-1. Needle thread breakage"		
	Gap between needle and rotary hook			
Needle plate	Needle plate position	Adjust needle plate front and rear position	Locate the needle at the center of needle hole 	-
	Burr on the screw hole edge (in event of uneven material feeding)	Polish with buff		-
Upper thread trimmer assembly	Needle strikes upper thread trimmer	Adjust so that the scissors do not touch the needle.	Refer to "5-11. Needle strikes upper thread trimmer"	
Cutter	Clearance between needle bar and cutter	Install the cutter so that the clearance between the needle bar and the cutter is 0.3 mm. The cutter release section of the needle bar should be at a right angle to the cutter.		4-6

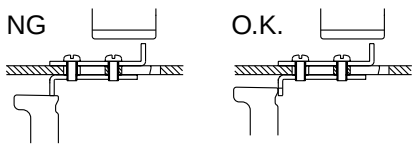
5-13. (1)Imperfect cutter function (imperfect material cutting)

Cause	Check	Solution		page
Cutter	Cutter position	Adjust cutter vertical height	Install the cutter so that its edge is aligned with the top of the needle plate. 	4-11
	Cutter blade	If the blade is worn or chipped, sharpen it or replace it.	Replace with the special needle plate.	- (Instruction)
Cutter solenoid	Check for a disconnected cord.	Connect the cords.		-
Cutter power	Memory switches	Increase the setting for memory switch No. 00. (cutter cutting force).	Increase the setting value for materials that are heavy or difficult to cut.	- (Instruction)
Solenoid stopper	Nut	Check for a loose nut.	Tighten securely.	-
	Cutter sensor position	Adjust the cutter sensor position. Check for a loose mounting screw.		4-9

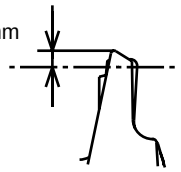
(2) Cutter does not return

Cause	Check	Solution		page
Cutter	Cutter blade	If the blade is worn or chipped, sharpen it or replace it.		- (Instruction)
Sticks in material	Needle plate	Replace with the special needle plate.	This needle plate uses the elasticity of rubber to prevent the knife from getting stuck and not returning. It also helps to keep the knife blade sharp.	4-11

(3) Cutter and upper thread scissors touch.

Cause	Check	Solution		page
Upper thread scissors	Is the cam opening the stop plate?	If the feed mechanism operates when the cam has not opened the stop plate, the cutter will bump against the upper thread scissors. Adjust the cam position.		4-18

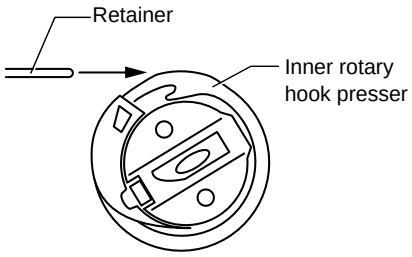
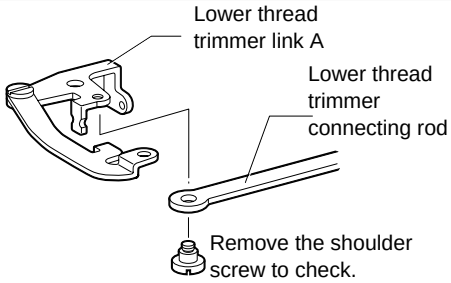
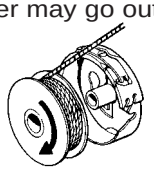
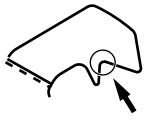
5-14. Needle thread mis-winding

Cause	Check	Solution		page
Upper thread scissors	Scissors installation height	Refer to "5-3. Uneven seams 1)"		
	Scissors gradual opening timing	Adjust the gradual opening timing to an appropriate setting.	Refer to "4-13-7. Adjusting the upper thread scissors gradual opening timing"	
	Upper thread scissors opening timing	Adjust the opening timing to an appropriate setting.	Refer to "4-13-8. Adjusting the upper thread scissors opening timing"	
	Upper thread trimmer movement	Polish blade of upper thread middle trimmer and upper thread guide with buffer Check for burrs on the top surface of upper thread middle trimmer Change the parts	In case of dull upper thread trimmer Refer to "5-9. Unraveling of thread trimmed by upper thread trimmer assembly" Refer to "5-11. Needle strikes upper thread trimmer"	-
	Lateral position of upper thread scissors	Adjust the lateral position of the upper thread scissors.	Approx. 1 mm 	4-14
Stitch quality	Needle thread tension	Decrease tension to such a degree that it does not influence stitch quality		- (Instruction)
	Zigzag width in the zigzag stitch portion	Widen zigzag width to such a degree that it does not influence stitch quality		- (Instruction)
Upper clamping foot	Uneven material feeding	Increase presser foot pressure (Press material so that the material is properly stretched)	When using knitted or woven material, change upper clamping foot for subclass -3 parts Parts to change Length feed plate (subclass -3) Upper clamping foot assembly (for knits) Needle plate 1.2 (subclass -3)	4-8
Underlay	Underlay sewing	Reduce the setting for the sewing start pitch for underlay sewing (parameter No. 52) to around 0.5. Reduce the underlay sewing speed (parameter No. 48).		- (Instruction)

5-15. Folding clamp is not raised (1) Pulse motor stepping sound cannot be heard

Cause	Check	Solution		page
Presser foot height setting	Check the presser foot height setting.	Change the settings of memory switch Nos. 04., 05. and 06..		- (Instruction)
Presser foot lifter pulse motor	Cord connection	Check the cord connections and contacts.		-
	Presser lifter pulse motor gear	Check for loose gear set screw.		-

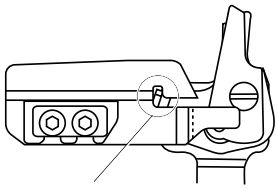
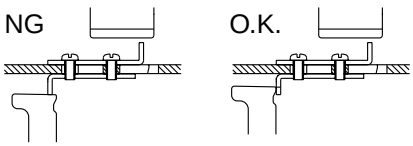
Folding clamp is not raised (2) Pulse motor stepping sound can be heard

Cause	Check	Solution		page
Machine stopping position	Rotary hook touches lower thread retainer at the stop position	Adjust the needle up stop position.		-
Presser foot rise speed is too fast	Memory switch No. 02. (presser foot rise speed)	Reduce the presser foot rise speed.	Change using memory switch No. 02..	- (Instruction)
Upper thread scissors	Interference between upper thread scissors and cloth presser	Check the standard adjustments, particularly for joint sewing.	Refer to "4-13-6. Adjusting the installation height of the upper thread scissors" (Remove the upper thread scissors to check.)	
	Upper thread scissors operation	Carry out upper thread scissors standard adjustments.		4-12
Lower thread trimmer	Interference between fixed knife set, lower thread clamp, lower thread presser and lower thread retainer.	Repair or replace the parts.		-
	Rubbish, dust or thread scraps present	Remove all rubbish, dust and thread scraps from the lower thread trimmer.		-
Loose screws	Check for loose screws in the upper thread trimmer, lower thread trimmer and presser lifter mechanisms.	Securely tighten all screws.		-
Presser foot lifter height	Memory switch Nos. 04., 05. and 06.	Adjust so that the memory switch setting value matches the presser foot rise height.	If the presser foot rise height is too high, the lower thread trimming and presser foot rising will become harder and the pulse motor may go out of step.	- (Instruction)
threading	Bobbin thread threading	Insert the bobbin correctly and pass the lower thread through the bobbin case correctly.	If the bobbin is inserted back-to-front, it will spin loosely and the presser lifter may go out of step. 	- (Instruction)
	Lower thread tension (if the lower thread tension is too strong, step errors may occur)	Reduce the lower thread tension. Reduce the setting for the presser foot lifting speed (memory switch No. 02.) to reduce the lifting speed.	Buff this section to reduce the thread retaining resistance. 	-
Presser foot lifter home position sensor	Presser foot lifter home position sensor position	Adjust the presser foot lifter home position sensor position.		4-5

5-16. Lower thread is not trimmed (pulls when material is removed)

Cause	Check	Solution		page
Machine stopping position	Rotary hook and lower thread retainer touch at the stop position.	Refer to "5-15. Folding clamp is not raised"		
Fixed knife set	Fixed knife and movable knife do not mesh.	Adjust the fixed knife set installation position.	Refer to "4-14-1. Adjusting the lower thread trimmer fixed knife engagement amount"	
	Knife tip is bent or chipped.	Repair or replace the knife.		-

5-17. Feed mechanism does not operate or motor is out of step

Cause	Check	Solution		page
Feed pulse motor	Cord connection	Check the cord connections and contacts.		-
Upper thread scissors	Upper thread scissors position	Remove and re-install the upper thread scissors.	 Projection on scissors M is inserted. * Always make sure that the upper thread scissors are in the correct position before us.	4-14
	Is the cam opening the stop plate?	If the feed mechanism operates when the cam has not opened the stop plate, the feed mechanism will go out of step and the cutter will bump against the upper thread scissors. Adjust the cam position.		4-17 4-18
Feed home position sensor	Feed home position sensor position	Adjust the feed home position sensor position.		4-3
Feed timming belt	Feed timing belt tension	Adjust the feed timing belt.		4-26

5-18. Needle does not zigzag or noise occurs when needle zigzags

Cause	Check	Solution		page
Zigzag home position sensor	Zigzag home position sensor position	Adjust the zigzag home position sensor position.		4-2
Stopper	Stopper position	Adjust the stopper position.		4-2

5-19. Sewing machine stops during sewing

Cause	Check	Solution		page
Thread breakage detector	Thread breakage detector position	Adjust the thread breakage detector.	If the detector is not adjusted, sewing may stop even when the thread is not broken.	4-24
Emergency stop	Panel DIP switch A-3	When panel DIP switch A-3 is set to ON, an emergency stop occurs when the treadle is depressed.	If the treadle is pressed firmly and then released, the treadle may be judged to have been depressed backwards and an emergency stop may occur.	- (Instruction)

6. ELECTRIC MECHANISM

6-1. Precautions at the time of adjustment

Pay attention to the following when opening the control box for maintenance.

■ Electric shock

Some large capacitors may have a high voltage remaining in them for up to 5 minutes after the power is turned off. To prevent electric shock, wait at least 5 minutes after the power is turned off before doing the following:

- Opening and closing the control box
- Replacing fuses
- Separating and joining connectors
- Measuring resistance
- Doing anything with a possibility of touching something inside the control box

Some adjustments require measuring the voltage while the power is turned on with the control box kept open. In such a case, be careful not to touch any place other than that for the measurement. In addition, always keep in mind that a high voltage remains for 5 minutes after the power is turned off.

■ Injury

While the power is turned on, the cooling fan of the control box operates; be careful not to get caught in it.

When separating or rejoining connectors, and measuring something, be careful not to cut your fingers on metal parts such as heatsinks and covers.

6-2. Components inside the control box and the operation panel

The following are brief explanations of components inside the control box. For details on connections, refer to "6-9. Control circuit block diagram".

- Main circuit board

  This circuit board is secured to the front cover (main PCB setting plate), and it control the pulse motors and solenoids.

- Sub circuit board

  This circuit board is secured to the rear cover (auxiliary PCB setting plate), and it drives the presser foot, feed pulse motor and cutter solenoid.

- 1-step power supply circuit board, 2-step power supply circuit board

  These are secured to the bases of the first and second levels of the control box, and they generate the voltages which are necessary for the various control operations.

- Panel PCB

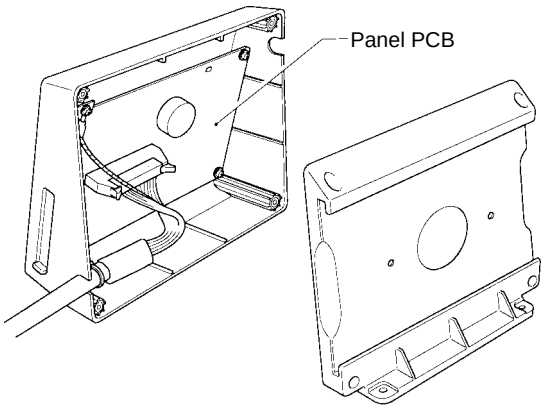
  The panel PCB is fixed to the front panel of the operation panel. This PCB controls indications of the machine status and the input operation.

- DC fan motor

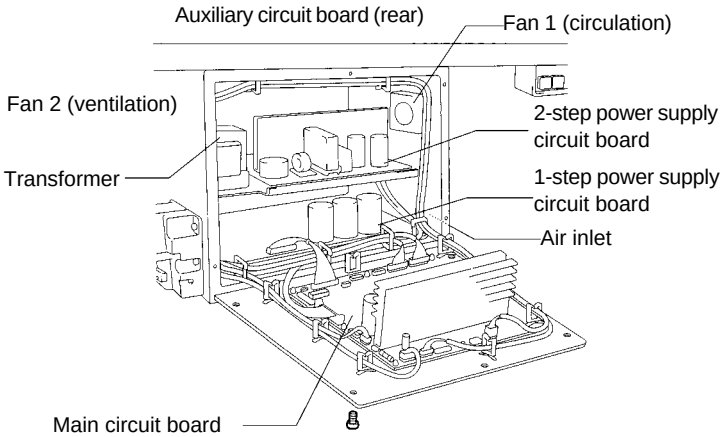
  The DC fan motor serves as a fan to cool the inside of the control box. Clean the inlet filter monthly.

- Transformer

  This is secured to the base of the second level of the control box, and it generate the voltages which are necessary for the various control operations.



Operation panel



Control box

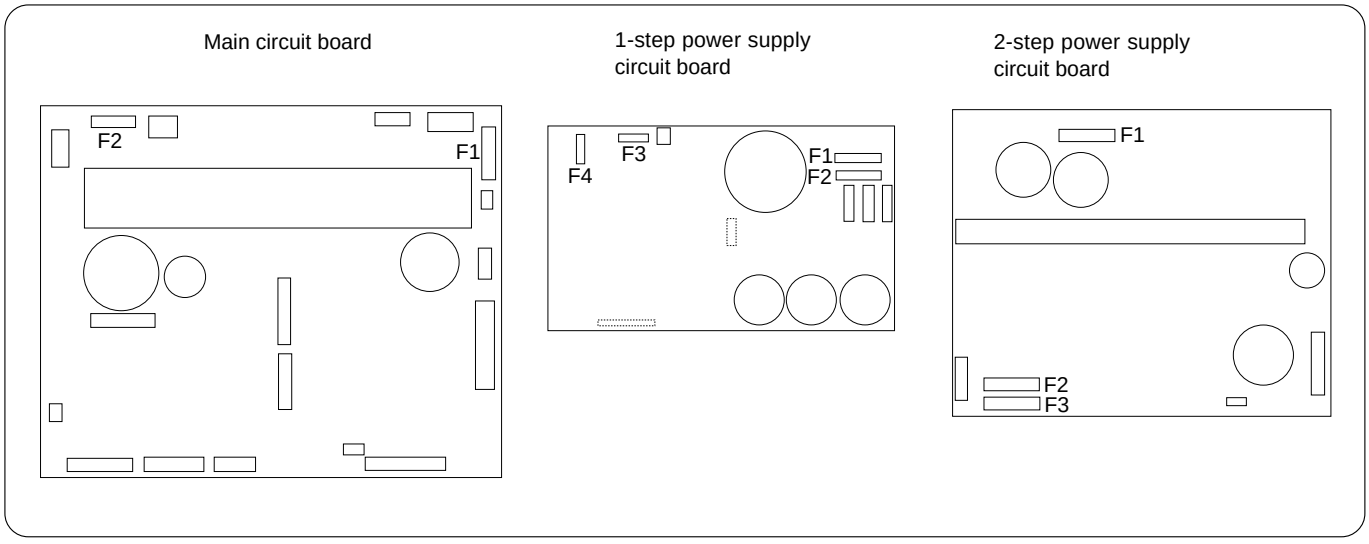
6-3. Fuse explanation

If a component on a PCB is damaged, a fuse may blow again immediately even when it has been replaced.
When replacing a fuse, be sure to use the specified ones listed below.

Circuit board	No.	Part name	Part code	When a fuse has blown	Voltage
Main circuit board	F1	GFUSE8A (glass tube fuse, 8A/250V)	S47680-000	The tension release solenoid does not operate.	+40V
	F2	GFUSEAFB (glass tube fuse, 8A/250V(FB))	S47717-000	The zigzag motor does not operate.	DC300V
1-step power supply circuit board	F1, F2	Fuse 15A#2 (glass tube fuse, 15A/250V)	218469-001	The zigzag motor does not operate. The tension release solenoid does not operate. The panel does not operate. The control box fan does not operate.	AC200V
	F3, F4	Fuse 2A250V (glass tube fuse, 2A/250V)	J02727-001	The feed motor and presser foot motor do not operate. The cutter solenoid does not operate. The panel does not operate.	DC300V
2-step power supply circuit board	F1	G fuse 5AFB (quick melting type, 5A/250V)	S08030-000	The feed motor and presser foot motor do not operate. The cutter solenoid does not operate.	+55V
	F2	Fuse 6A (glass tube fuse, 6A/250V)	153242-000	The feed motor and presser foot motor do not operate. The cutter solenoid does not operate.	AC200V
	F3	Fuse 6A (glass tube fuse, 6A/250V)	153242-000	The feed motor and presser foot motor do not operate. The cutter solenoid does not operate.	AC200V

* F2 may also blow as a result of a malfunction of the peripheral electronic component FET.

Open the cover. The fuses are mounted to the circuit boards as shown.

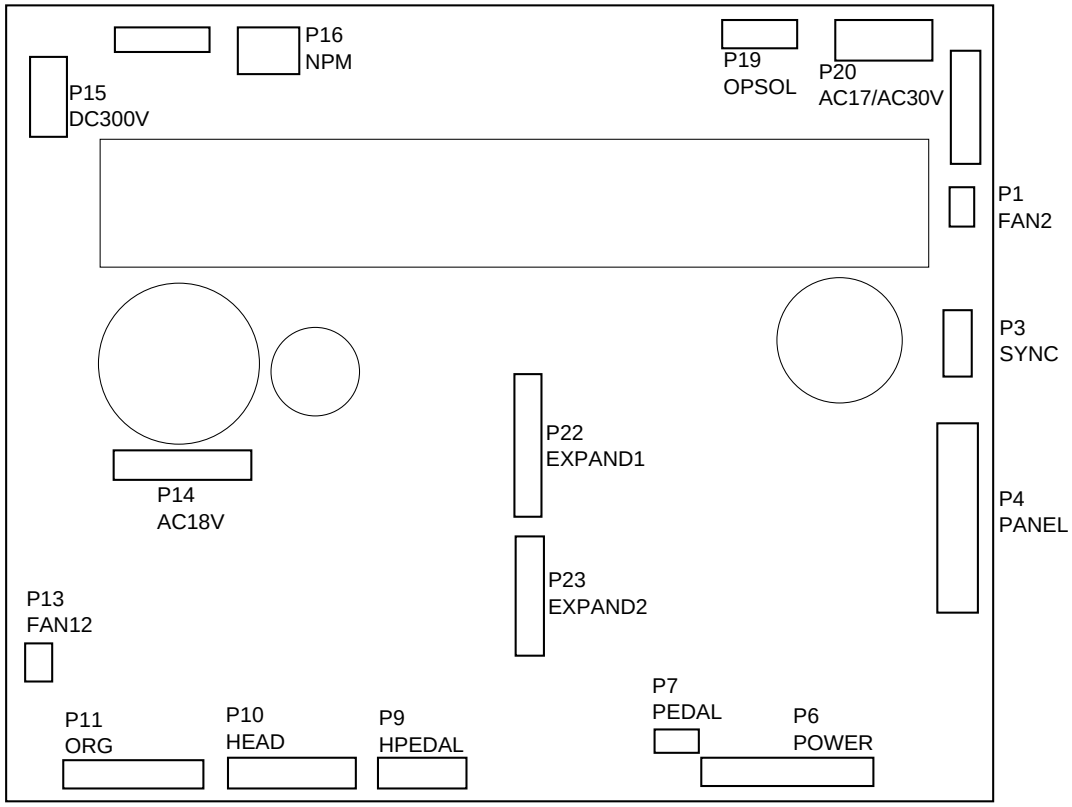


6-4. Connectors

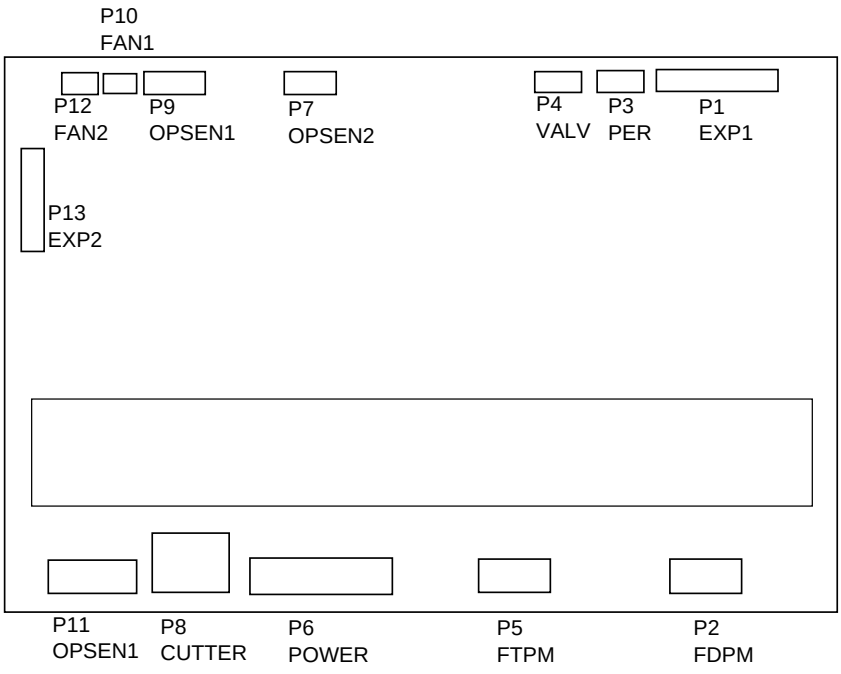
Most of the machine trouble is due to connector problems including improper connection or insufficient contact. Therefore, be sure to check if each connector is correctly inserted and that there is no contact failure between pins and wires before starting troubleshooting procedures.

■ Connector positions

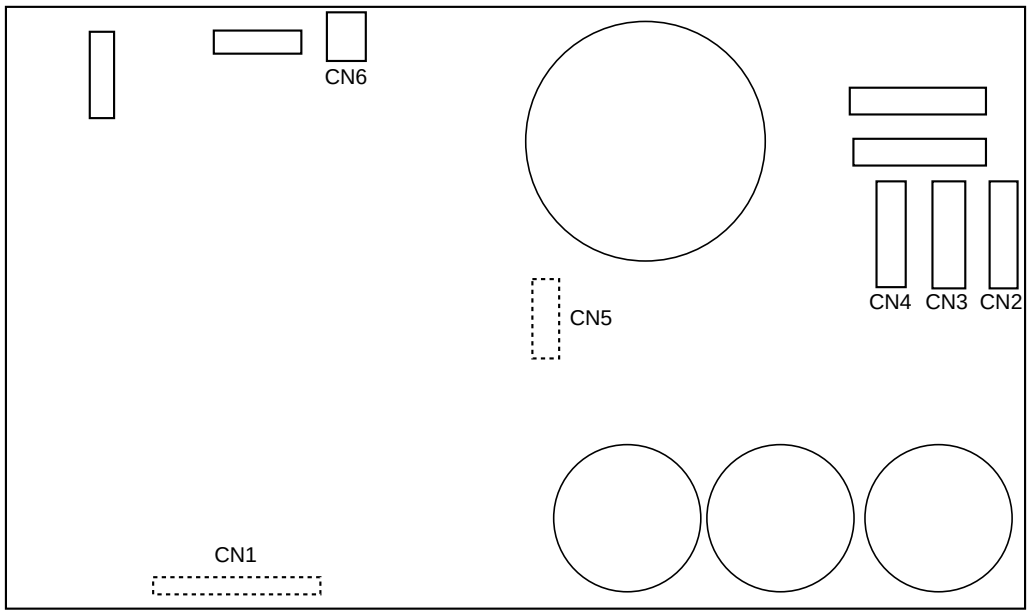
Main circuit board



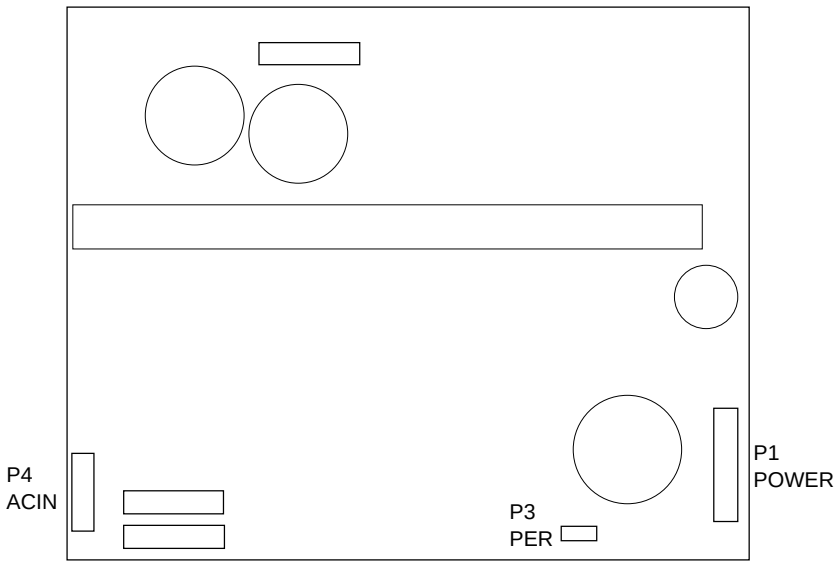
Sub circuit board



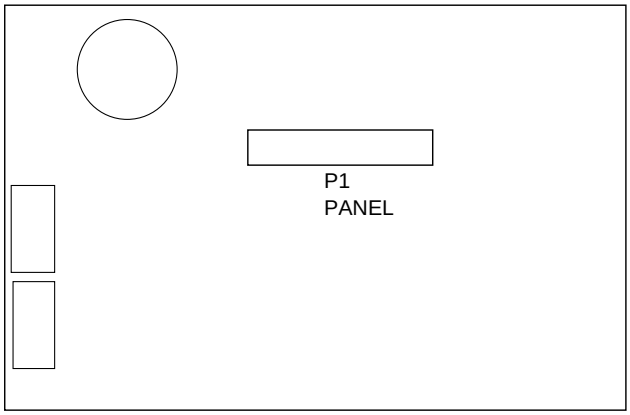
1-step power supply circuit board



2-step power supply circuit board



Panel PCB



Circuit board connectors

<Main circuit board>

P1 [FAN2]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	The inside air circulation fan does not operate. Error E-41 is displayed.
2	FAN2 signal	
3	0V	

P3 [SYNC]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+5V	The machine motor does not turn. A machine stopping error occurs. One of error E-02, E-62, E-63 and E-64 is displayed.
2	Encoder signal	
3	Needle up stop position signal	
4	Needle down stop position signal	
5	0V	

P4 [PANEL]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+5V	The panel does not operate.
2	0V	
3	KEY0	
4	KEY1	
5	KEY2	
6	OC	
7	A	
8	B	
9	C	
10	D	
11	E	
12	F	
13	G	
14	STB	
15	P8V	
16	SENSOR	
17	BUZZER	
18	0V	
19	0V	
20	0V	

P6 [POWER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	P8V (+8V)	The panel power lamp does not light. The machine motor does not turn.
2	0V	
3	N8V (-8V)	
4	OV. det	
5	RY. out	
6	OV. FAULT	
7	+5V	
8	PHOTO	
9	U	
10	V	
11	W	
12	U	
13	V	
14	W	
15	IPM. FAULT	

P7 [PEDAL]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	P8V (+8V)	The home position can not be found. The presser foot does not operate. The machine does not operate. One of error E-30, E-31 and E-32 is displayed.
2	PEDAL signal	
3	0V	
4	N8V (-8V)	

P9 [HPEDAL] Standing operation pedal (option)		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	P8V (+8V)	The home position can not be found. The presser foot does not operate. The machine does not operate. One of error E-30, E-31 and E-32 is displayed.
2	FORSW signal	
3	BAKSW signal	
4	0V	
5	INCHSW signal	
6	PRSW signal	
7	HPEDAL signal	

P10 [HEAD]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Emergency stop NC signal	The emergency stop switch does not operate. The thread breakage detection does not operate normally.
2	0V	
3	Emergency stop NO signal	
4	+24V	
5	-	
6	0V	
7	+5V	
8	Thread breakage detection signal	
9	-	
10	P8V (+8V)	
11	0V	

P11 [ORG]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	The home position can not be found. One of error E-05, E-06 and E-07 is displayed.
2	Zigzag home position signal	
3	0V	
4	+5V	
5	+24V	
6	Feed home position signal	
7	0V	
8	+5V	
9	+24V	
10	Presser foot home position signal	
11	0V	
12	+5V	

P13 [FAN12]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	The exhaust fan does not operate. Error E-42 is displayed.
2	FAN1 signal	
3	0V	

P14 [AC18V]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	AC18V (+D10V)	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed.
2	AC18V (+D10V)	
3	-	
4	-	
5	AC18V (N)	
6	AC18V (N)	
7	-	
8	-	
9	AC18V (A)	
10	AC18V (A)	
11	-	
12	-	
13	AC18V (B)	
14	AC18V (B)	
15	-	
16	-	
17	AC18V (C)	
18	AC18V (C)	
19	-	
20	-	
21	AC18V (D)	
22	AC18V (D)	
23	-	
24	-	
25	AC18V (E)	
26	AC18V (E)	
27	-	
28	-	
29	AC18V (F)	
30	AC18V (F)	

P15 [DC300V]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	DC300V	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed.
2	DC0V	

P16 [NPM]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Zigzag PM driving current A	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed.
2	Zigzag PM driving current B	
3	Zigzag PM driving current C	
4	Zigzag PM driving current D	
5	Zigzag PM driving current F	
6	-	

P19 [OPSOL]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Spare solenoid	The tension release solenoid does not operate.
2	-	
3	Tension release solenoid	
4	-	
5	+40V	
6	+40V	

P20 [AC17/AC30V]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	AC30V	The tension release solenoid does not operate. The control box fan does not operate. One of error E-41 and E-42 is displayed.
2	AC30V	
3	-	
4	AC17V	
5	AC17V	

P22 [EXPAND1]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+5V	The zigzag home position, feed home position and presser foot home position can not be found. The zigzag mechanism, feed mechanism and presser foot mechanism do not operate. One of error E-05, E-06 and E-07 is displayed. +55 V (power supply for driving the feed mechanism and work clamp PM) control is not possible Error E-44 is displayed. The valve does not operate.
2	+5V	
3	+5V	
4	+5V	
5	+24V	
6	+24V	
7	+24V	
8	+24V	
9	Feed PM clock	
10	Presser foot PM clock	
11	-	
12	-	
13	Presser foot PM direction signal	
14	Feed PM direction signal	
15	Presser foot PM current control signal	
16	Feed PM current control signal	
17	PM current OFF signal	
18	-	
19	-	
20	-	
21	VALV1	
22	VALV2	
23	VALV3	
24	VALV4	
25	VALV5	
26	VALV6	
27	+55V OFF signal	
28	+55V relay output signal	
29	0V	
30	0V	
31	0V	
32	0V	

P23 [EXPAND2]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Input signal spare 1	The zigzag home position, feed home position and presser foot home position can not be found. The zigzag mechanism, feed mechanism and presser foot mechanism do not operate. One of error E-05, E-06 and E-07 is displayed. The cutter does not operate. Error E-08 is displayed.
2	Input signal spare 2	
3	Input signal spare 3	
4	Input signal spare 4	
5	Input signal spare 5	
6	Cutter home position sensor signal	
7	Feed PM overcurrent signal	
8	Presser foot PM overcurrent signal	
9	+55V relay input signal	
10	+55V voltage watch signal	
11	-	
12	-	
13	0V	
14	0V	
15	0V	
16	0V	
17	-	
18	-	
19	-	
20	-	
21	Cutter return signal	
22	Cutter signal	
23	Cutter signal	
24	Spare solenoid 1	
25	Spare solenoid 2	
26	Spare solenoid 3	

<Sub circuit board>

P1 [EXP1]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+5V	The zigzag home position, feed home position and presser foot home position can not be found. The zigzag mechanism, feed mechanism and presser foot mechanism do not operate. One of error E-05, E-06 and E-07 is displayed. +55 V (power supply for driving the feed mechanism and work clamp PM) control is not possible Error E-44 is displayed. The valve does not operate.
2	+5V	
3	+5V	
4	+5V	
5	+24V	
6	+24V	
7	+24V	
8	+24V	
9	Feed PM clock	
10	Presser foot PM clock	
11	-	
12	-	
13	Presser foot PM direction signal	
14	Feed PM direction signal	
15	Presser foot PM current control signal	
16	Feed PM current control signal	
17	PM current OFF signal	
18	-	
19	-	
20	-	
21	VALV1	
22	VALV2	
23	VALV3	
24	VALV4	
25	VALV5	
26	VALV6	
27	+55V OFF signal	
28	+55V relay output signal	
29	0V	
30	0V	
31	0V	
32	0V	

P2 [FDPM]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Feed PM driving current A	The feed home position can not be found. The feed mechanism does not operate. Error E-06 is displayed.
2	Feed PM driving current B	
3	Feed PM driving current C	
4	Feed PM driving current D	
5	Feed PM driving current F	

P3 [PER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Relay input signal	The feed home position and presser foot home position can not be found. The feed mechanism and presser foot mechanism do not operate. One of error E-06 and E-07 is displayed. +55 V (power supply for driving the feed mechanism and work clamp PM) control is not possible Error E-44 is displayed.
2	0V	
3	+55V relay output signal	
4	+55V OFF signal	
5	0V	

P4 [VALV]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	VALV1	(Special edition)
2	VALV2	
3	VALV3	
4	VALV4	
5	VALV5	
6	VALV6	
7	-	
8	-	
9	+24V	
10	+24V	

P5 [FTPM]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Presser foot PM driving current A	The presser foot home position can not be found. The presser foot mechanism does not operate. Error E-07 is displayed.
2	Presser foot PM driving current B	
3	Presser foot PM driving current C	
4	Presser foot PM driving current D	
5	Presser foot PM driving current F	

P6 [POWER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+55V (PM)	The feed home position and presser foot home position can not be found. The feed mechanism and presser foot mechanism do not operate. One of error E-06 and E-07 is displayed. The cutter does not operate. Error E-08 is displayed.
2	+55V (PM)	
3	P0V	
4	P0V	
5	+24V	
6	0V	
7	M55V (Cutter)	
8	M55V (Cutter)	
9	MP0V	
10	MP0V	

P7 [OPSEN2]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	The cutter does not operate. Error E-08 is displayed.
2	+5V	
3	Input signal spare 4	
4	0V	
5	+24V	
6	+5V	
7	Input signal spare 5	
8	0V	
9	+24V	
10	+5V	
11	Cutter home position sensor signal	
12	0V	

P8 [CUTTER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Cutter driving current	The cutter does not operate. Error E-08 is displayed.
2	-	
3	Cutter return driving current	
4	Cutter driving current	
5	-	
6	Cutter return driving current	

P9 [OPSEN1]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	Special edition
2	+5V	
3	Input signal spare 1	
4	0V	
5	+24V	
6	+5V	
7	Input signal spare 2	
8	0V	
9	+24V	
10	+5V	
11	Input signal spare 3	
12	0V	
13	0V	
14	0V	

P10 [FAN1]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	The feed pulse motor cooling fan does not spin.
2	FAN1 signal	
3	0V	

P11 [OPSEN1]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+55V	Special edition
2	+55V	
3	+55V	
4	Spare solenoid driving current 7	
5	Spare solenoid driving current 8	
6	Spare solenoid driving current 9	

P12 [FAN2]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+24V	Special edition
2	Spare input	
3	0V	

P13 [EXP2]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Input signal spare 1	The zigzag home position, feed home position and presser foot home position can not be found. The zigzag mechanism, feed mechanism and presser foot mechanism do not operate. One of error E-05, E-06 and E-07 is displayed. The cutter does not operate. Error E-08 is displayed.
2	nput signal spare 2	
3	nput signal spare 3	
4	nput signal spare 4	
5	nput signal spare 5	
6	Cutter home position sensor signal	
7	Feed PM overcurrent signal	
8	Presser foot PM overcurrent signal	
9	+55V relay input signal	
10	+55V voltage watch signal	
11	-	
12	-	
13	0V	
14	0V	
15	0V	
16	0V	
17	-	
18	-	
19	-	
20	-	
21	Cutter return signal	
22	Cutter signal	
23	Cutter signal	
24	Spare solenoid 1	
25	Spare solenoid 2	
26	Spare solenoid 3	

<1-step power supply circuit board>

CN1

Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	P8V (+8V)	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed. The machine motor does not turn.
2	0V	
3	N8V (-8V)	
4	OV. det	
5	RY. out	
6	OV. FAULT	
7	+5V	
8	PHOTO	
9	U	
10	V	
11	W	
12	U	
13	V	
14	W	
15	IPM. FAULT	

CN2

Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	AC200-R	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed. The tension release solenoid does not operate.
2	AC200-T	
3	-	
4	-	

CN3

Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	AC220-R	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed. The tension release solenoid does not operate.
2	-	
3	AC220-T	
4	-	

CN4

Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	AC230/240-R	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed. The tension release solenoid does not operate.
2	-	
3	-	
4	AC230/240-T	

CN5		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	DC300V	The zigzag home position can not be found. The zigzag mechanism does not operate. Error E-05 is displayed.
2	DC0V	

CN6		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Resistance	Voltage error occurs. Error E-95 is displayed.
2	Resistance	

<2-step power supply circuit board>

P1 [POWER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+55V (PM)	The feed home position and presser foot home position can not be found. The feed mechanism and presser foot mechanism do not operate. One of error E-06 and E-07 is displayed. The cutter does not operate. Error E-08 is displayed.
2	+55V (PM)	
3	P0V	
4	P0V	
5	+24V	
6	0V	
7	M55V (Cutter)	
8	M55V (Cutter)	
9	MP0V	
10	MP0V	

P3 [PER]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	Relay input signal	The zigzag home position, feed home position and presser foot home position can not be found. The zigzag mechanism, feed mechanism and presser foot mechanism do not operate. One of error E-05, E-06 and E-07 is displayed. +55 V (power supply for driving the feed mechanism and work clamp PM) control is not possible Error E-44 is displayed.
2	0V	
3	+55V relay output signal	
4	+55V OFF signal	
5	0V	

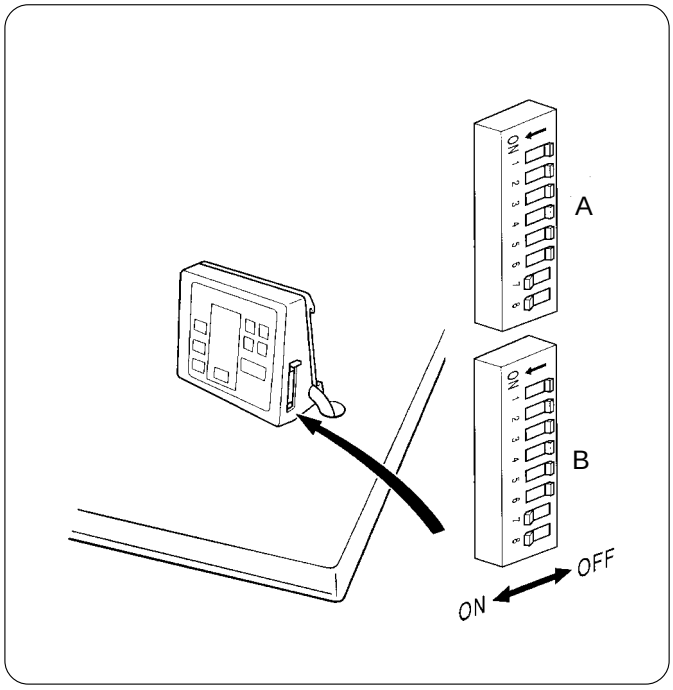
P4 [ACIN]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	ACIN	The feed home position and presser foot home position can not be found. The feed mechanism and presser foot mechanism do not operate. One of error E-06 and E-07 is displayed.
2	ACIN	
3	-	
4	EARTH	

<Panel PCB>

P1 [PANEL]		
Pin No.	Signal name	Symptoms resulting mainly from poor contact
1	+5V	The panel does not operate.
2	0V	
3	KEY0	
4	KEY1	
5	KEY2	
6	OC	
7	A	
8	B	
9	C	
10	D	
11	E	
12	F	
13	G	
14	STB	
15	P8V	
16	SENSOR	
17	BUZZER	
18	0V	
19	0V	
20	0V	

6-5. Description of DIP switches

6-5-1. Panel DIP switches



1. Slide the panel side cover to open it.
2. Change the DIP switch setting.
   • Refer to the DIP switch table for an explanation of the functions of each DIP switch.
3. Slide the panel side cover downward to close it.

NOTE:
Turn the power off before changing the DIP switch settings.
If the settings are changed while the power is still on, they will not take effect.

DIPSWA

No.		Setting item	Default
1	ON	Presser foot remains lowered after sewing is complete (lifts when pedal is depressed)	OFF
	OFF	Presser foot lifts after sewing is complete	
2	ON		OFF
	OFF		
3	ON	Emergency stop using presser foot lifter switch enabled during automatic sewing	OFF
	OFF	Emergency stop using presser foot lifter switch disabled during automatic sewing	
4	ON	Display setting during automatic mode = lower thread counter (Default: 100)	OFF
	OFF	Display setting during automatic mode = production counter (Default: 0)	
5	ON	2-cycle sewing ON (All programs will be set to 2-cycle sewing regardless of the setting for parameter No. 55.)	OFF
	OFF	2-cycle sewing OFF	
6	ON		OFF
	OFF		
7	ON	Upper thread breakage detection disabled	OFF
	OFF	Upper thread breakage detection enabled	
8	ON	Programs disabled	OFF
	OFF	Programs enabled	

DIPSWB

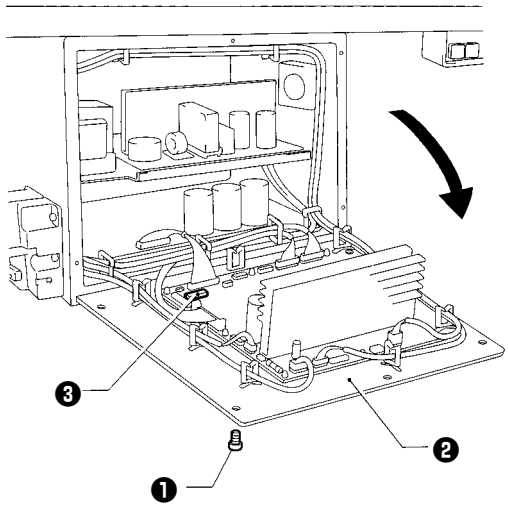
No.		Setting item	Default
1	ON		OFF
	OFF		
2	ON		OFF
	OFF		
3, 4, 5	ON, ON, ON	Work clamp size: 7.3 × 75 mm (6.0 × 70 mm)	OFF, OFF, OFF
	ON, ON, OFF	Work clamp size: 7.3 × 36 mm (6.0 × 32 mm)	
	ON, OFF, ON	Work clamp size: 7.3 × 24.5 mm (6.0 × 20 mm)	
	ON, OFF, OFF	Work clamp size: 6.8 × 36 mm (5.4 × 32 mm)	
	OFF, ON, ON	Work clamp size: 6.8 × 24.5 mm (5.4 × 20 mm)	
	OFF, ON, OFF	Panel DIP switches B-7 and B-8 are enabled.	
	OFF, OFF, ON	Work clamp size: 5.4 × 19 mm (4.0 × 15 mm)	
	OFF, OFF, OFF	Panel DIP switches B-7 and B-8 are enabled.	
6	ON	Needle plate size: 5.4 mm (Max. needle zigzag feed width = 4.0 mm)	OFF
	OFF	Needle plate size: 7.3 mm (Max. needle zigzag feed width = 6.0 mm)	
7, 8	ON, ON	Work clamp size: 7.3 × 47 mm (6.0 × 40 mm)	OFF, OFF
	ON, OFF	Work clamp size: 6.8 × 47 mm (5.4 × 40 mm)	
	OFF, ON	Work clamp size: 5.4 × 24.5 mm (4.0 × 20 mm)	
	OFF, OFF	Work clamp size: 5.4 × 36 mm (4.0 × 32 mm)	

* If the programs are initialized when Nos. 3, 4 and 5 are set to OFF, OFF and ON (work clamp size 5.4 x 19 mm [4.0 x 15 mm]) respectively, the initial value for parameter No. 02 - Cutter size will be set to 6.0.

6-5-2. Control circuit board DIP switches

⚠ DANGER

Wait at least 5 minutes after turning off the power switch and disconnecting the power cord from the wall outlet before opening the face plate of the control box. Touching areas where high voltages are present can result in severe injury.



NOTE:

Turn the power off before changing the DIP switch settings.

If the settings are changed while the power is still on, they will not take effect.

1. Remove the six screws ❶, and then open the operator's side cover ❷ of the control box.

NOTE:

When opening the cover ❷, hold it securely so that it does not fall down.

2. Change the setting of the DIP switch ❸.
   - Refer to the DIP switch table for an explanation of the functions of each DIP switch.
3. Close the cover ❷ of the control box, and tighten the six screws ❶.

DIPSW1

No.		Setting item	Default
1	ON		OFF
	OFF		
2	ON		OFF
	OFF		
3	ON		OFF
	OFF		
4	ON		OFF
	OFF		
5	ON		OFF
	OFF		
6	ON		OFF
	OFF		
7	ON	Three warning beeps	OFF
	OFF	Continuous warning beep	
8	ON	Needle feed motor excitation turned off during emergency stop and thread breakage	OFF
	OFF	Needle feed motor excitation not turned off during emergency stop and thread breakage	

DIPSW2

No.		Setting item	Default
1	ON	Pedal: for standing operation	OFF
	OFF	Pedal: for seated operation	
2	ON	Starting possible only when presser foot is lowered	OFF
	OFF	Starting possible regardless of presser foot position	
3	ON		OFF
	OFF		
4, 5	ON, ON		OFF, OFF
	ON, OFF		
	OFF, ON		
	OFF, OFF		
6	ON	100V, 110V specifications	OFF/ON
	OFF	200V, 400V specifications	
7	ON		OFF
	OFF		
8	ON		OFF
	OFF		

6-6. Description of machine motor parameters

* To change the machine motor parameters, press and hold the ENTER key and then turn on the power. Machine motor parameter setting mode will then start.
* Do not change the default values for the machine motor parameters unless it is absolutely necessary to do so.

No.	Setting items	Setting range	Unit	Default
00	Machine motor stopping position	5 - 70 (Forward for larger values)	1	47
01	Machine motor braking force	5 - 15 (stronger for larger values))	1	11
02	Machine motor braking time	50 - 500 ms	10	70
03	Machine motor acceleration time	5 - 70 (faster for larger values)	1	46 (13)
04	Machine motor deceleration time	5 - 70 (faster for larger values)	1	46
05	Machine motor stopping speed	150 - 200 rpm	10	190
06	Spare			
07	Spare			
08	Spare			
09	Spare			

* If the machine motor parameters are initialized for 100 V and 110 V specifications, the machine motor acceleration time will become 13.

- The program number LED shows the machine motor parameter number.
- When a program No. key is pressed, the machine motor parameter number changes as follows.
- The value shown in the parameter display LED can be changed by pressing the parameter keys.
- The display flashes while it is being changed.
- When the ENTER key is pressed, the value appearing in the parameter display LED is accepted (the display stops flashing).
- When the motor select key is pressed, machine motor parameter setting mode will then end and the sewing machine will start up normally.

6-7. ERROR CODE TABLE

⚠ DANGER

⚠ Wait at least 5 minutes after turning off the power switch and disconnecting the power cord from the wall outlet before opening the face plate of the control box. Touching areas where high voltages are present can result in severe injury.

If a malfunction should occur with the sewing machine, a buzzer will sound and an error code will appear in the display window.
Follow the remedy procedure to eliminate the cause of the problem.
For errors which do not require the power to be turned off (i.e. errors which can be reset), two short beeps will sound. For error E-02, three short beeps will sound.
For errors which require the power to be turned off (i.e. errors which cannot be reset), a single long beep will sound.

Code	Cause	Remedy
E-00	EMERGENCY STOP switch was pressed.	To restart sewing: Press the parameter down key and then depress the treadle to step 2. To cancel sewing : Press the RESET key.
E-01	Upper thread breakage	To restart sewing: Press the parameter down key and then depress the treadle to step 2. To cancel sewing : Press the RESET key.
E-02	Needle up sensor is OFF.	Turn the machine pully by hand to raise the needle.
E-05	Zigzag positioning is not carried out.	Turn off the power.
E-06	Feed positioning is not carried out.	Turn off the power.
E-07	Presser foot positioning is not carried out.	Turn off the power.
E-08	Cutter home position sensor is off.	Turn off the power.
E-20	Feed and presser foot motor overcurrent	Turn off the power.
E-21	Zigzag motor overcurrent	Turn off the power.
E-30	Threadle is depressed to step 2.	Return the treadle to the neutral position.
E-31	Threadle is depressed to step 1.	Return the treadle to the neutral position.
E-32	Threadle is depressed backward.	Return the treadle to the neutral position.
E-40	Control board heat sink is overheating.	Turn off the power.
E-41	Inside air circulation fan problem	Turn off the power.
E-42	Exhaust fan problem	Turn off the power.
E-44	2-step power supply circuit board +55V relay error	Turn off the power.
E-51	X pitch error	Turn off the power.
E-52	Y pitch error	Turn off the power.
E-54	Overall cycle program stitch no. error	Exceeds 3,000 stitches. Clear the cycle program and reset automatically.
E-55	Stitch no. error	Exceeds 700 stitches. Turn off the power.

E-59	Sewing data error	Turn off the power. Re-initialize the programs.
E-62	Needle up error during operation	Turn off the power.
E-63	Needle down error during operation	Turn off the power.
E-64	Timing signal error during operation	Turn off the power.
E-74	EEPROM error	Turn off the power.
E-75	RAM error	Turn off the power.
E-80	Communication ready error	Turn off the power.
E-81	Communication error	Turn off the power.
E-90	Machine motor overload	Excessive load during sewing. Turn off the power.
E-92	Machine motor operation error	Turn off the power.
E-93	Blown solenoid fuse	Turn off the power. Replace the fuse.
E-94	Machine motor IC error	Turn off the power.
E-95	Power supply voltage error (high)	Power supply voltage is too high. Turn off the power.
E-96	Power supply voltage error (low)	Power supply voltage is too low. Turn off the power.
E-97	Machine motor locked	Excessive load during sewing. Turn off the power.
ArEA	Sewing data values exceed the needle plate size or work clamp size which have been set using the panel DIP switches.	Three resetting methods are available depending on the application. A. By selecting a different program number (If you would like to keep the program which exceeds the area.) Press the SELECT key. Select a different program number. Press the ENTER key. If the data for the selected program number does not exceed the sewing area, the error will be cleared. B. By initializing the program While pressing the ENTER key, press the RESET key. * All parameters (00 to 69) for the program will then be initialized and the machine will switch to program mode. C. By initializing all programs Refer to "13. PROGRAM INITIALIZATION".
C-Er	When using the multi-working knife, the knife operation distance cannot be reduced.	Three resetting methods are available depending on the application. A. Replace the knife with a longer knife. Press the SELECT key to change to automatic mode. Press the SELECT key to change to program mode. Enter the length of the new knife as the setting for parameter 02 (Length of knife). Press the SELECT key to change to automatic mode. * If "C-Er" is displayed again, replace with an even longer knife. B. By initializing the program Initialize only the programs which cause "C-Er" to be displayed. While pressing the ENTER key, press the RESET key. * All parameters (00 to 69) for the program will be initialized. C. Change the zigzag pitch and zigzag stitch length (multi-working knife). 1. Press the SELECT key to change to automatic mode.Press the SELECT key to change to program mode. 2. Reduce the setting value for parameter 04 (Zigzag pitch). Increase the setting for parameter 03 (Zigzag stitch [multi-working knife]). 3. Press the SELECT key to change to automatic mode. * If "C-Er" is still displayed, repeat steps 1. to 3.

6-8. Troubleshooting

Code	Countermeasure
E-00	1. Turn off emergency stop switch. 2. Check if connector P10 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. With the power turned off, separate connectors P10, and check if continuity between the following pairs of pins 1 to 3 in the connector on the harness is as follows: - When emergency stop switch is activated, between pins 1 and 2 is opened, and between pins 2 and 3 is short-circuited. - When emergency stop switch is not activated, between pins 1 and 2 is short-circuited, and between pins 2 and 3 is opened. * If the result of continuity test is not acceptable in either case, replace the emergency stop switch. 4. If there is still an error even after replacing the emergency stop switch, replace the main circuit board.
E-01	1. Check if connector P10 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check the operation of the thread breakage sensor monitor lamp. - When the dog is nearby, the monitor lamp lights. - When the dog moves away, the monitor lamp switches off. * If the result of continuity test is not acceptable in either case, replace the thread breakage detection sensor. 3. If there is still an error even after replacing the thread breakage detection sensor, replace the main circuit board.
E-02	1. Turn the pulley manually to set the needle to its highest position. 2. Check if connector P3 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. Replace the synchronizer. 4. If there is still an error even after replacing the synchronizer, replace the main circuit board.
E-05	1. Check if connector P11 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check the operation of the zigzag home position sensor monitor lamp. - When the dog is nearby, the monitor lamp lights. - When the dog moves away, the monitor lamp switches off. * If the result of continuity test is not acceptable in either case, replace the zigzag home position sensor. 3. If there is still an error even after replacing the zigzag home position sensor, replace the main circuit board.
E-06	1. Check if connector P11 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check the operation of the feed home position sensor monitor lamp. - When the dog is nearby, the monitor lamp lights. - When the dog moves away, the monitor lamp switches off. * If the result of continuity test is not acceptable in either case, replace the feed home position sensor. 3. If there is still an error even after replacing the feed home position sensor, replace the main circuit board.

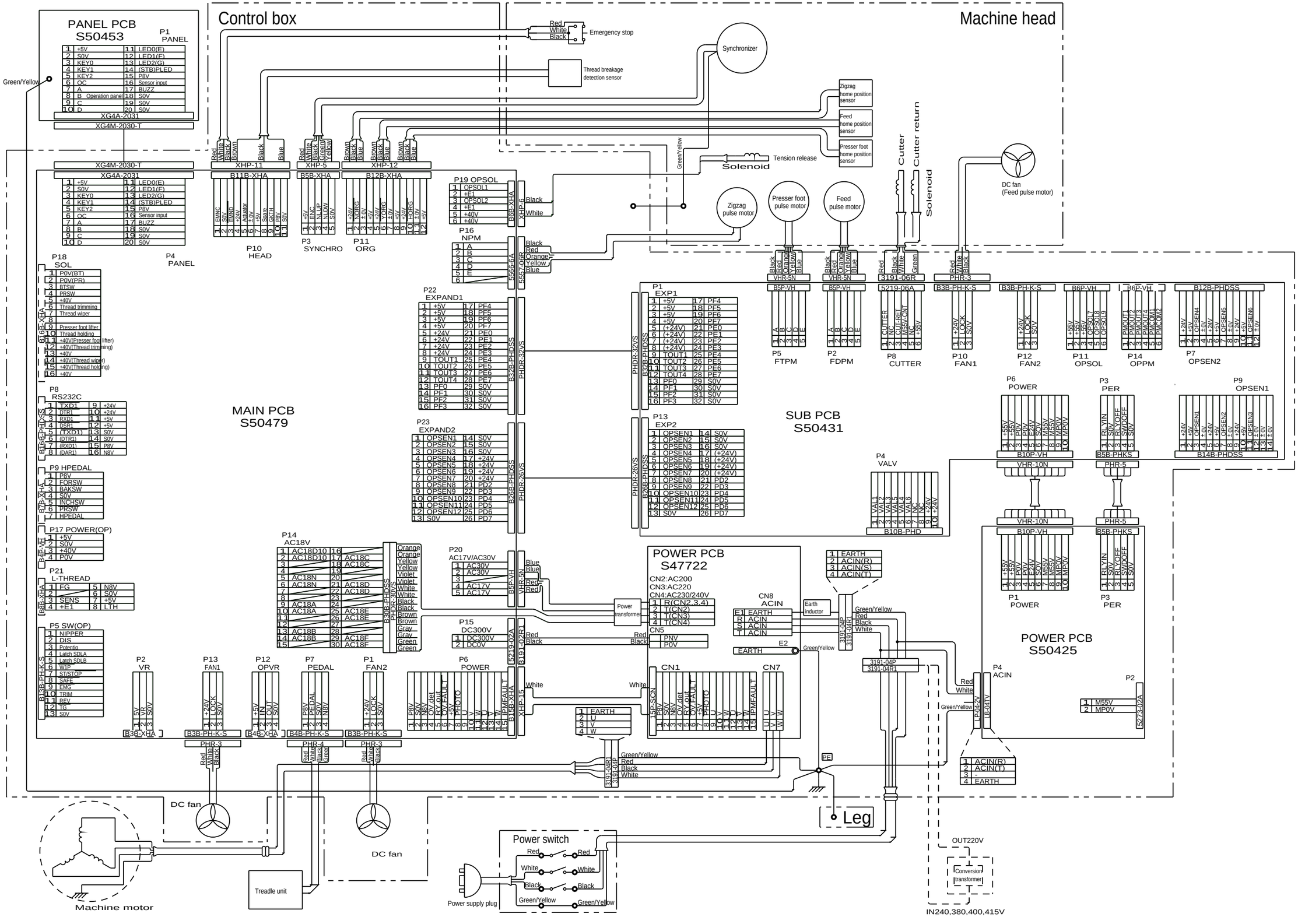
Code	Countermeasure
E-07	<If E-07 occurs other than when machine is moving to the home position or starting> 1. Check if connector P11 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check the operation of the presser foot home position sensor monitor lamp. - When the dog is nearby, the monitor lamp lights. - When the dog moves away, the monitor lamp switches off. * If the result of continuity test is not acceptable in either case, replace the presser foot home position sensor. 3. If there is still an error even after replacing the presser foot home position sensor, replace the main circuit board. 4. Check the sewing machine operation, particularly the operation of the upper thread trimming mechanism, and eliminate the cause of the problem. <If E-07 occurs when machine is starting> 1. Presser lifter pulse motor goes out of step during sewing machine operation. Check the upper thread trimming mechanism, particularly for wear in the opening cam. (Refer to "4-13-7. Adjusting the upper thread scissors gradual opening timing" and apply grease to part C.)
E-08	1. Check if connector P7 on the sub circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check if connectors P23 on the main circuit board and P13 on the sub circuit board are securely inserted and if any harness is broken or short-circuited. 3. Check the operation of the cutter home position sensor monitor lamp. - When the dog is nearby, the monitor lamp lights. - When the dog moves away, the monitor lamp switches off. * If the result of continuity test is not acceptable in either case, replace the cutter home position sensor. 4. If there is still an error even after replacing the cutter home position sensor, replace the sub circuit board. 5. If there is still an error even after replacing the sub circuit board, replace the main circuit board.
E-20	1. With the power turned off, check for problems with feeding and check that the presser foot moves smoothly. 2. Check if connectors P2 (feed) and P5 (presser foot) on the sub circuit board are securely inserted and if any harness is broken or short-circuited. * And also check if connectors P23 on the main circuit board and P13 on the sub circuit board are securely inserted and if any harness is broken or short-circuited. 3. Replace the pulse motor that is malfunctioning. 4. Replace the sub circuit board.
E-21	1. With the power turned off, check if the zigzag mechanism moves smoothly. 2. Check if connector P16 (zigzag) on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. Replace the zigzag pulse motor. 4. Replace the main circuit board.
E-30 E-31 E-32	1. Turn off treadle unit. 2. Check if connector P7 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. Replace the treadle unit. 4. If there is still an error even after replacing the treadle unit, replace the main circuit board.
E-40	1. Make sure that the control box is normally ventilated. 2. Clean the filter of the air intake. (Remove dust.) 3. Clean the cooling fan. (Remove dust.) 4. Make sure that the cooling fan is attached correctly.
E-41	1. Clean the inside air circulation cooling fan. (Remove dust.) 2. Check if connectors P13 and P20 on the main circuit board are securely inserted and if any harness is broken or short-circuited. 3. Turn power off, check if connectors CN2, CN3 and CN4 on the 1-step power supply circuit board are securely inserted and if any harness is broken or short-circuited. * OK if 17 V AC is present between pins 4 and 5 of connector P20 on the main circuit board. If not OK, replace the transformer. 4. Replace the cooling fan. 5. Replace the main circuit board.

Code	Countermeasure
E-42	1. Clean the exhaust cooling fan. (Remove dust.) 2. Check if connectors P1 and P20 on the main circuit board are securely inserted and if any harness is broken or short-circuited. 3. Turn power off, check if connectors CN2, CN3 and CN4 on the 1-step power supply circuit board are securely inserted and if any harness is broken or short-circuited. * OK if 17 V AC is present between pins 4 and 5 of connector P20 on the main circuit board. If not OK, replace the transformer. 4. Replace the cooling fan. 5. Replace the main circuit board.
E-44	1. Check if connector P3 on the sub circuit board is securely inserted and if any harness is broken or short-circuited. 2. Check if connector P3 on the 2-step power supply circuit board is securely inserted and if any harness is broken or short-circuited. 3. Check if connectors P10 and P13 on the sub circuit board are securely inserted and if any harness is broken or short-circuited. 4. Check if connectors P22 and P23 on the main circuit board are securely inserted and if any harness is broken or short-circuited. 5. Replace the 2-step power supply circuit board. 6. Replace the sub circuit board. 7. Replace the main circuit board.
E-51 E-52	1. Turn off the power and initialize the settings.
E-54	1. Automatically resets after 2 minutes. (Sewing data of 3,000 stitches or less will be valid, and any sewing data past the 3000th stitch will be invalid.)
E-55	1. Turn off the power and then back on again. (Zigzagging and bar tacking will automatically be halved, so the error display will disappear.) 2. If error E-55 appears again after the above operation is carried out, turn off the power and initialize the settings.
E-59	1. Turn off the power and initialize the settings. 2. If error E-59 appears again after the above operation is carried out, replace the man circuit board.

Code	Countermeasure
E-62	<Software> 1. If the sewing machine stops before the needle up position, reduce the setting value for machine motor parameter No. 00 (machine motor stopping position). 2. If the sewing machine stops after the needle up position, increase the setting value for machine motor parameter No. 00 (machine motor stopping position). <Hardware> 1. Turn the machine pulley by hand and check if the upper shaft locks or not. (If it locks, remove the cause of the problem.) 2. Check if connector P3 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. Check if the machine motor harnesses are securely inserted and if any harness is broken or short-circuited. 4. Replace the synchronizer. 5. If there is still an error even after replacing the synchronizer, replace the main circuit board.
E-63 E-64	1. Turn the machine pulley by hand and check if the upper shaft locks or not. 2. Check if connector P3 on the main circuit board is securely inserted and if any harness is broken or short-circuited. 3. Replace the synchronizer. 4. If there is still an error even after replacing the synchronizer, replace the main circuit board.
E-74	1. Replace the main circuit board.
E-75	1. Replace the main circuit board.
E-80 E-81	1. Make sure that ROM chips of the main circuit board are correctly inserted. (Check position, orientation, lead clinching.) 2. Replace the main circuit board.
E-90 E-92 E-94	1. Turn the machine pulley by hand and check if the upper shaft locks or not. 2. Check if connectors P3 and P6 on the main circuit board are securely inserted and if any harness is broken or short-circuited. 3. Check if machine motor harness connector CN7 and power supply harness connector CN8 on the 1-step power supply circuit board are securely inserted and if any harness is broken or short-circuited. 4. Replace the 1-step power supply circuit board. 5. Replace the main circuit board.
E-93	1. Check fuse F1 on the main circuit board. 2. If fuse F1 on the main circuit board is blown, replace it.

Code	Countermeasure
E-95 E-96	1. Check the power supply voltage in the workplace and the power supply voltage specifications for the control box. 2. Check the connection positions of connectors CN1 and CN2 on the 1-step power supply circuit board. * 200V specification --- CN2 * 220V specification --- CN3 * 230V specification --- CN4 * 100, 110, 240, 380, 400, 415V specification --- CN3
E-97	1. Check if the timing belt is attached. 2. Turn the machine pulley by hand and check that the upper shaft does not lock and the pulley is not loose. 3. Check if connectors P3 and P6 on the main circuit board are securely inserted and if any harness is broken or short-circuited. 4. Check if machine motor harness connector CN7 and power supply harness connector CN8 on the 1-step power supply circuit board are securely inserted and if any harness is broken or short-circuited. 5. Replace the 1-step power supply circuit board. 6. Replace the main circuit board.
ArEA	Refer to "6-7. Error code table".
C-Er	Refer to "6-7. Error code table".

6-9. Control circuit block diagram



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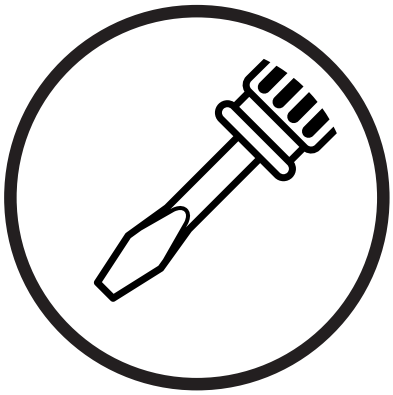

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